ANNUAL REPORT

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NATIONAL AERONAUTICS
AND
SPACE ADMINISTRATION

OFFICE OF
ENGINEERING RESEARCH
OKLAHOMA STATE UNIVERSITY

A PROGRAM FOR SELECTING, EDITING AND DISSEMINATING ENGINEERING AND SCIENTIFIC SUBJECT MATTER FROM NASA TECHNICAL REPORTS

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A PILOT PROGRAM FOR SELECTING, EDITING AND DISSEMINATING ENGINEERING AND SCIENTIFIC EDUCATIONAL SUBJECT MATTER FROM NASA TECHNICAL REPORTS

ANNUAL REPORT

September 1, 1967 through November 30, 1968

COLLEGE OF ENGINEERING
OKLAHOMA STATE UNIVERSITY
STILLWATER, OKLAHOMA

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National Aeronautics and Space Administration

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A PILOT PROGRAM FOR SELECTING, EDITING AND DISSEMINATING ENGINEERING AND SCIENTIFIC EDUCATIONAL SUBJECT MATTER FROM NASA TECHNICAL REPORTS

A. SUMMARY

"The objective of the NASA Pilot Program was to test the feasibility of introducing into graduate and undergraduate engineering school curricula educational enrichment materials resulting from space generated research and development." [1] Educational Monographs were distributed to 255 professors in 108 universities. The concept of the Educational Monograph was positively received: 11 favorable responses for each unfavorable response. Visual Briefs were distributed to 73 professors in 46 universities. The concept of Visual Briefs was received with similar success.

Although this is an annual report, progress of the entire program is presented in many places to illustrate total achievement. The nature of the program requires this type of presentation. Details of quarterly or yearly progress are shown when it enhances the presentation.

In The Statement of Work for the second contract period a number of objectives particularly significant to the program have been listed. A reference to these objectives and the achievements accomplished during the preparation, distribution and evaluation of the Educational Monographs follows.

Objective

"Source materials selected shall include NASA technical reports and they shall cover a topic within one of the three subject areas, Heat Transfer, Thermodynamics, and Control Systems..." [2]

Achievement

All of the Educational Monographs prepared for distribution in the NASA Pilot Program have used NASA technical reports as source material and have covered topics in the prescribed subject areas.

Subject Area	Number of Monographs
Heat Transfer	8
Thermodynamics	7
Control Systems	10

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[1] Article I, Statement of Work, Appendix X, page

[2] Ibid.

Objective

"The number of Monographs to be prepared when added to those completed under (the initial period of) Contract NSR 37-002-045, shall not exceed 30 without prior approval from TUD. The minimum number to be completed is 28."[3]

Achievement

The following information summarizes the Monograph preparation during the entire period of the contract up to October 15, 1968.

		Number of Monographs
1.	Ready for distribution	20
2.	Being reproduced for distribution	2
3.	Being readied for reproduction	3
4.	Developed--not reproduced because of technical difficulties	4
	Total	29

Objective

"The contractor shall provide for the evaluation of each Monograph by at least 10 participating professors for each Monograph tested...."

"In order to provide a sufficiently broad base for objective evaluation the contractor will attempt to enlist the cooperation of professors at 25 participating institutions at the least. Consideration should be given to geographical dispersion as well as other factors in this selection." [4]

Achievement

A total of 255 professors in 108 universities located in 39 states of the United States of America and 5 foreign countries have received Monographs. In addition to these educators, there were practicing engineers in 52 different industrial organizations who have also received Monographs. A total of 165 evaluations have been returned from the 57 evaluators in 40 universities located in 29 states, and 26 practicing engineers in 9 industrial organizations.

Objective

"The evaluation of Monographs should stem from qualitative opinions of participating professors. The contractor will elicit such criticism and comment through use of a questionnaire prepared in such a way as to gather objective information regarding usefulness of the material to the professor, its technical value, and any other important factors."[5]

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[3] Ibid.

[4] Ibid.

[5] Ibid.

Achievement

An appropriate evaluation form was designed (Appendix XI) and was forwarded to each recipient of an instructor's copy of an Educational Monograph.

The evaluators responded satisfactorily in the evaluation questionnaire. They provided numerous specific comments on the Monographs received in addition to responding to objective questions. Their comments are shown in Appendix XII. Figure 3 illustrates graphically the number of evaluation forms received for each Monograph as returned by the evaluators.

Objective

"It is anticipated that no fewer than 5 and no more than 10 Visual Briefs will be approved (during the second contract period) for trial dissemination during the contract period."[6]

Achievement

It is mutually agreed by Oklahoma State University and the Technical Monitor, NASA, during the second contract period that additional Visual Briefs would not be prepared during this contract period.

Objective

"The contractor shall provide for the evaluation of each Visual Brief in at least 5 different classrooms, workshops, or seminar sessions..."[7]

Achievement

A total of 111 evaluations have been received from users of Visual Briefs. Figure 4 illustrates graphically the number of evaluations received for each Visual Brief.

General Evaluation

An analysis of the evaluations received from Oklahoma State University evaluation efforts, evaluations of reviews by the National Science Foundation, and meetings with representatives of the Technology Utilization Division of NASA indicates a need for Educational Monographs in engineering education.

Oklahoma State University evaluations have shown that the following general requirements must be met in providing Educational Monographs.

1. Author should be a respected authority and writer in the subject area.
2. Topic of the Educational Monograph should be new and significant to the subject area; one not covered in recent textbooks.

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[6] Ibid.

[7] Ibid.

3. Contents of the Monograph should be sufficiently detailed to cover the topic but concise enough to be covered in preferably one hour lectures -- not more than three hours.

4. Contents should cover sufficient amount of background material applicable to the topic to eliminate undue research on the part of the using professor and students.

5. Monographs should be reviewed for content,clarity, and accuracy by the author and editor.

6. Monographs should be based on a specific topic but not necessarily limited to one source document.

The overall evaluation of the program does indicate a need for further development of the concept.

Recommendations

The following functions need further development to prepare a realistic analysis of the concept and to determine its future direction.

1. Arrange and conduct colloquia of "valued" consultants and Monograph authors to evaluate and analyze the Educational Monograph program and its results.

2. Create approximately 5 additional Educational Monographs, incorporating those changes in format and technique based on our experience and evaluations.

3. Continue to apply effort to obtain additional evaluations of Educational Monographs.

4. Apply additional effort in surveying the industrial prospects for the Educational Monographs.

5. Develop positive future plans for expanded implementation of the program from results of colloquia, Monograph evaluations, and general analysis of the entire NASA Pilot Program.

6. Continue to solicit additional support for the developmental phase of the Educational Monograph program from other agencies, institutes, foundations, and private organizations.

B. PROLOGUE

Engineering educators and practicing engineers have difficulty in keeping abreast of new technological advances being created in research and development laboratories throughout the world. An individual in either phase of the engineering profession today finds it a near impossible task to keep up with the state-of-the-art if he is required to search the literature documenting new technology and to glean useful information for himself. It is physically impossible to individually review all new documents at the rate they are being produced. To attempt such a task can result only in an inefficient expenditure of the valuable time of many practicing engineers and teachers.

In general, engineering societies do not have the manpower, time, or inclination to edit and publish an adequate amount of material in a form suitable for educational purposes that can be used by educators and practicing engineers. They prefer to publish original research results that have not been published elsewhere and which are more appropriately fitted for the limited space available in these journals. However, engineering societies have recently expressed interest in developing new methods of augmenting textbook material with current literature in a form similar to the Educational Monographs.

Representatives of book publishers have reported that the format of the Educational Monograph does not fit into their present mode of operation. The book publishers believe that the marketing of Monographs would only partially support a continuing program of creating Educational Monographs. Greater selection of Monographs is needed in each subject area to assure frequent use by engineering educators. Although the book publishers are not optimistic on the paper back concept, they have not completely turned it down; one major company's representative continues to check with Oklahoma State University on the program's progress!

A Center for Creating Educational Monographs in Engineering, established at Oklahoma State University in June, 1966, has the objective of providing up-to-date instructional material derived from current research to educators and practicing engineers. Recognized authorities in their fields have provided the guidance for a systematic search of the literature, the selection of appropriate educational material in their subject areas, and the preparation of the written Monographs for use as supplementary material in the classroom, in the industrial seminar, and for individual study. Monographs prepared from documentation of NASA research efforts have been written in the subject areas of heat transfer, thermodynamics and control systems.

The Monographs resulting from the Center's program are primarily based on one or more research reports and are commonly supplemented by other material. They are desinged to augment textbook and class-note material in a course of instruction. The material is sufficiently complete to be used in one to three hours of instruction. Where possible, the Monographs contain and develop only one central idea. A homework problem and its solution are included when applicable. These Educational Monographs produced have been circulated widely for use both in university classrooms and by practicing engineers.

C. PROGRAM BACKGROUND

HISTORY OF PROGRAM

On March 16, 1966, the College of Engineering at Oklahoma State University submitted an unsolicited proposal entitled "A Pilot Program for Selecting, Editing and Disseminating Engineering and Scientific Educational Subject Matter from NASA Technical Reports" to the office of Technology Utilization of the National Aeronautics and Space Administration. The program was approved and is presently funded under NASA Contract NSR 37-002-045 for $210,099 for the period of June 1, 1966 through November 30, 1968.

A Center for Creating Educational Monographs in Engineering was established in June, 1966, with the objective of systematically reviewing NASA Technical Reports for information of significant benefit to the engineering and physical sciences educational programs. The resulting information was formulated as Educational Monographs suitable for supplementary text materials in advanced undergraduate and graduate classes as well as in technical short courses and seminars.

The office of Technology Utilization of NASA through its Western Support Office had implemented a program to develop Visual Briefs (technical films). Since the Monograph and Visual Brief programs were closely related as technology transfer techniques, they were combined into a single program. The NASA Western Support Office supplied the unedited technical films and Oklahoma State University provided the selection, reproduction, dissemination and evaluation capability in conjunction with the implementation of the Educational Monograph program.

The Virginia Polytechnic Institute became involved in the Educational Monograph program through the participation of Dr. William A. Blackwell. Dr. Blackwell contributed in the early planning of the initial program as a faculty member of the Electrical Engineering department at Oklahoma State University. Subsequently, Dr. Blackwell became Head of Electrical Engineering at Virginia Polytechnic Institute. A subcontract with the Virginia Polytechnic Institute was written to allow Dr. Blackwell to be a senior author in the program and to investigate a procedure for allowing qualified authors located in any university to participate and contribute in such a program.

FUNCTION OF THE PROGRAM

New technological information usually is published first as a technical report and then tends to migrate through other forms of published material until it makes its way into textbooks. Up to six or more years may be required for new technology to be included in textbooks for use in the classroom. This program of producing Educational Monographs helps to conserve the time of many faculty members by having the literature search and writing done by a few while making the results available to many.

A program for the systematic searching of new technology and preparing the resulting material for educational use makes available many new developments that might otherwise contribute only to the solution of a single problem. The inevitable result of the absence of such a program would be the unnecessary reinvention or rediscovery of much in technology. The Monographs produced from the literature searches are designed to present significant contributions to engineering education and practicing engineers.

SUBJECT AREAS

The subject areas selected for the pilot program were heat transfer, thermodynamics, and control systems. Twenty Monographs have been completed for distribution in these subject areas. Abstracts of these Monographs are included in Appendix VI. Five additional Monographs are in various stages of preparation and reproduction.

CENTER PERSONNEL

The initial program was organized by Dr. Clark A. Dunn, Associate Dean Emeritus of the College of Engineering, and Dr. Kenneth A. McCollom, Assistant Dean of the College of Engineering. The Center is presently directed by Dr. Kenneth A. McCollom with the assistance of Mr. Robert L. Overton, Deputy Director. Dr. Clark A. Dunn is Director Emeritus and a consultant for the Center. Monograph authors are faculty members of Oklahoma State University, Virginia Polytechnic Institute and Kansas State University. Resumes for Dr. McCollom, Dr. Dunn and Mr. Overton are shown in Appendix I.

PILOT PROGRAM OBJECTIVES

The NASA Pilot Program is a limited program developed solely to determine the initial acceptance of the Monograph concept by educators and practicing engineers. The program was designed to prepare and disseminate a limited number of documents in selected subject areas to obtain an evaluation of the Monograph format and material. Details of the objectives of the program are shown in the two work statements contained in Appendix X.

D. EDUCATIONAL MONOGRAPHS

Definition

An Educational Monograph is defined as a technical paper that develops a single topic based on one or more technical reports and possibly supplemented by other published material or original work of the author. The Educational Monograph is designed for use by engineering faculty members for use in advanced undergraduate or graduate engineering classes or practicing engineers and scientists for self-study programs. They are developed for one to three hours of instruction. The subject material may include: (1) a new application of some principle regularly taught, (2) a new method of solving a typical problem, (3) the demonstration of some new application of a known principle, or (4) the presentation of new technical data for engineering use. These Monographs are segmented supplementary units of textbook material. Educational Monographs are presently limited to the Engineering Sciences, in particular, the subject areas of heat transfer, thermodynamics and control systems.

Modes of Writing

The mode of operation used to produce Educational Monographs must be attractive to the senior author to gain his participation. He is the key person in the production of Monographs and is expected to be qualified as a recent textbook author or as a recognized authority in his field, as an experienced engineer, and as an experienced teacher. In the process of producing Monographs, he must be able to recognize new and significant material in his field; he must be able to develop a complete and accurate presentation of the new contribution to engineering; and he must be able to write or edit the Monograph in such a way as to make it valuable as supplementary teaching and learning material in his field. An individual with these qualifications has many places where he can fruitfully apply his labors, so a satisfactory mode of operation of the Monograph program is important.

Three primary methods of operation have been used for writing Monographs. With the first method, the senior author does all of his own development of material and writing with minor assistance from a graduate associate when desired. This procedure uses a considerable amount of the senior author's time. With the second method, an experienced engineering professor in the field takes the material selected by the senior author and prepares it as supplementary textbook material under the guidance of the senior author. With this method, both the senior author and the supporting experienced engineering professor are regular, salaried participants in the program. The third method modifies this procedure slightly by hiring the experienced engineering professor as a consultant at an appropriate hourly stipend to prepare the Monograph from the material selected by the senior author.

The senior author then edits and prepares the material for final typing. Experience in this method of operation was obtained under the guidance of a senior author, Dr. John A. Wiebelt, working with a former student, Dr. Paul A. Miller, a professor in Mechanical Engineering at Kansas State University, who did the writing. This procedure is closely related to the writing arrangement textbook authors have with professional book publishers.

The senior author-consultant author mode of operation provided the most economical method of writing Monographs. An average cost of four Monographs prepared under this mode of writing averaged $1,700 per document compared to $4,200 for the average cost of 29 documents. However, the Senior Author-Graduate Student mode of writing has its place in the program as it apparently works well when the topic requires a great amount of technical development of the source material.

Monograph Preparation

Two Educational Monographs were completed during the period September 1, 1968 through October 31, 1968. They were:

1. TD-2, "Thermodynamic Equations, Data and Techniques for Preparing Properties Compilations"

2. TD-6, "Enthalpies of Co-existing Equilibrium Vapor and Liquid Mixtures from Solubility Data and Equation of State Calculations"

by Wayne C. Edmister, Chemical Engineering, Oklahoma State University.

A total of 20 Educational Monographs are completed and ready for immediate distribution. Two additional Monographs are being reproduced. They are:

1. CS-7, "An Example of Gain Insensitive Design by State Variable Feedback"

2. CS-8, "Synthesis of Minimal Sensitivity Sampled-Data Control Systems"

by William A. Blackwell and Leonard L. Grigsby, Electrical Engineering, Virginia Polytechnic Institute.

Three other Monographs have required some additional preparation and will be readied for reproduction in the near future. They are:

1. HT-9, "Thermal Modeling in a Simulated Space Environment" by P. L. Miller, Mechanical Engineering, Kansas State University, and J. A. Wiebelt, Mechanical Engineering, Oklahoma State University.

2. CS-9, "An Example of Decoupling in the Design of Multivariable Control Systems" by William A. Blackwell and Leonard L. Grigsby, Electrical Engineering, Virginia Polytechnic Institute.

3. CS-10, "Realization of a Digital Controller" by William A. Blackwell and Leonard L. Grigsby, Electrical Engineering, Virginia Polytechnic Institute.

A total of 25 Educational Monographs will be completed for use in engineering education. Four other Monographs were developed through the literature search and preliminary writing stages. However, these were not completed when it became apparent that for technical reasons the material would not be suitable for instructional purposes. The titles of these incompleted Monographs were:

1. HT-6, "Condensation of Liquid Metals"

2. TD-2*, "Process Derivatives"

3. TD-7, "Densities of Co-existing Equilibrium Vapor and Liquid Mixtures from x,y, Data via the Isothermal Gibbs-Duhem Equation"

4. HT-9*, "The Grover Heat Pipe"

Authors of two of the incompleted Educational Monographs hope to eventually overcome the technical problems and complete them for future issue.

Review of Educational Monographs

A total of 1508 instructor copies and 5842 student copies of Educational Monographs have been mailed to individuals who have requested them for review or use in a classroom situation. Appendix II shows statistics on the copies mailed to educators while Appendix III tabulates statistics of those requested by individuals in industrial organizations.

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*This number has been reassigned to a completed Educational Monograph.

E. VISUAL BRIEF

A Visual Brief is a technical film which was produced as a part of the analysis process in a research study at one of the NASA Research Centers. The films consist largely of unedited segments of test film selected to aid in the illustration of an engineering principle. The technical films are useful for presentation in an engineering classroom, seminar or technical meeting.

Supplementary documentary material is supplied with each Visual Brief. The material suggests the types of information that might be involved in the film, the types of groups which might profitably use the Visual Brief and the recommended procedure for preparation by the professor before he uses the Visual Brief in a group presentation.

The number of Visual Briefs ready for distribution to universities and industrial organizations remains at 21. With the close of the NASA Western Support Office it was mutually agreed between Oklahoma State University and NASA Technology Utilization Office that no new Visual Briefs would be developed during this period, September 1, 1967 through November 30, 1968. However, the existing films would continue to be supplied upon request.

The Visual Briefs were disseminated to potential users on a trial basis. Methods of informing the potential users are outlined in Section F of this report. A total of 286 requests to use the technical films have been received; 250 requests have been filled. The 36 requests have not been filled because borrowing institutions have not been prompt in returning the Visual Briefs. Appendix VII shows the statistics on the films mailed to requesters.

F. MONOGRAPH DISSEMINATION

Educational Monographs have been requested by 255 professors in 108 universities which were located in 39 states of the United States of America and 5 foreign countries. A total of 1,508 instructor copies and 5,842 student copies have been mailed to these educators.

In January, 1968, it was mutually agreed to extend the Educational Monograph program to include industrial organizations. As a result of this effort in the spring, 1968, a total of 583 instructor copies and 166 student copies were requested by practicing engineers in 52 industrial organizations.

As illustrated in Figure 1, the total number of instructor copies requested by educators and practicing engineers has increased from 206 on August 31, 1967 to 1,924 on August 31, 1968. This increase of 1,718 during the year can be attributed to the following methods of informing potential users of the Educational Monographs concept and merits.

1. Papers Presented

Dr. Kenneth A. McCollom, NASA Pilot Program Administrator, was invited to present papers on the Educational Monograph program to the following four organizations.

March 12, 1968

Fifth Space Congress
Cocoa Beach, Florida

April 9, 1968

Tenth Annual Thermodynamics Conference, School of Chemical Engineering, Oklahoma State University, Stillwater, Oklahoma

June 5-6, 1968

NASA Technology Utilization Conference
Langley Research Center
Newport News, Virginia

June 17-20, 1968

ASEE Annual Convention
University of California at Los Angeles
Los Angeles, California

In each of the papers, Dr. McCollom made a presentation on the value of Educational Monographs in providing engineering educators with new technology prepared in a format that was desirable for classroom use and for self-study by practicing engineers.

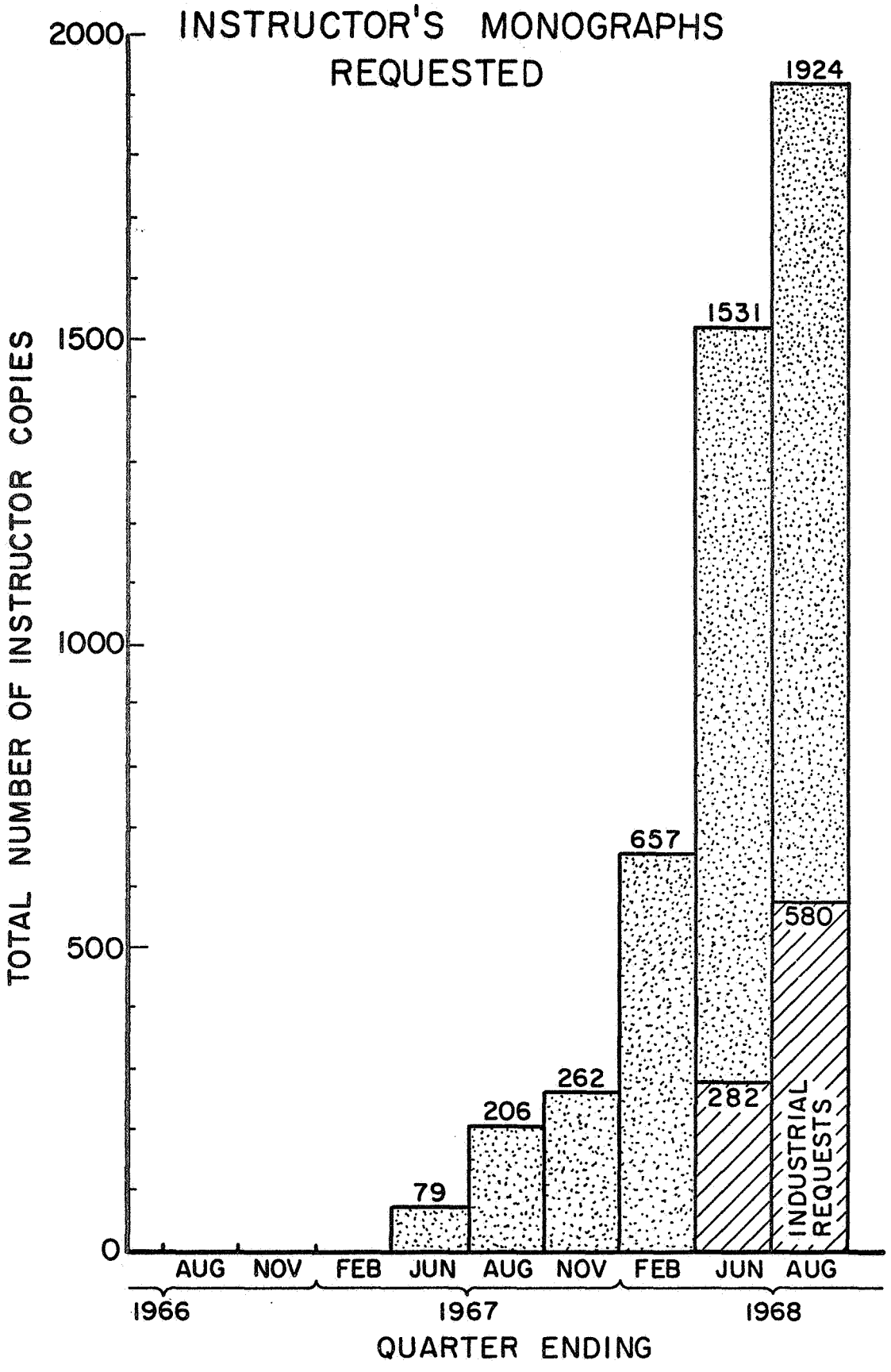
INSTRUCTOR'S MONOGRAPHS REQUESTED
TOTAL NUMBER OF INSTRUCTOR COPIES
2000
1500
1000
500
0
79
206
262
657
1531
282
1924
580
INDUSTRIAL REQUESTS
AUG
NOV
FEB
JUN
AUG
NOV
FEB
JUN
AUG
1966
1967
1968
QUARTER ENDING

Figure 1

2. Journal Advertisement

A full page advertisement describing Educational Monographs and Visual Briefs was placed in the January, 1968, issue of the Journal of Engineering Education to create an interest in educators and industrial training supervisors for Monographs and Visual Briefs. A reprint of the advertisement is shown in Appendix V.

The Journal of Engineering Education was selected because it is the official magazine of the American Society for Engineering Education. The Journal reaches administrators and teachers of engineering and engineering technology as well as industrial and government leaders concerned with engineering education. The Journal has readers in all 50 states and in over 70 foreign countries.

3. Letters to Deans

Letters describing Educational Monographs and Visual Briefs were mailed to 189 Deans of Engineering. The Deans membership roster of the American Society for Engineering Education was the source of names and addresses. The letters were used to stimulate interest in the program with the Deans and their respective faculties.

4. Letters to Industry

A form letter describing Educational Monographs and their potential use as a continuing education tool was mailed to 205 industrial organizations that maintain an industrial membership in the American Society for Engineering Education. Practicing engineers in 52 industrial organizations have requested Educational Monographs for their review or use. Appendix IV describes the Industrial Program which was developed as an additional phase of the contract.

5. Book Publishers

The following book publishers were contacted to determine if they had an interest in marketing Educational Monographs.

(a) John Wiley and Sons, Inc., New York

(b) McGraw-Hill Book Company, Inc., New York

(c) D. Van Nostrand Company, Inc., Princeton

(d) John McCutchan Corporation, San Francisco

In summary, it was concluded from the discussions with book publishers that the format of the Educational Monograph doesn't fit their present mode of operation. It was also concluded that the book publishers believe that the marketing of Monographs would only partially support a continuing program of creating Educational Monographs. Indications are that a greater selection of Monographs are needed in each subject area to assure frequent use by engineering educators. Comments by the book publishers are shown below:

John McCutchan Corporation is a book company that deals primarily in small groupings of published material. Mr. John McCutchan discussed the program in detail and concluded that the marketing of Monographs could not support the program. He said Monographs were particularly feasible for library or reference purposes, which is a limited market.

D. Van Nostrand Company, Inc., questioned the economics of preparing and marketing paperbacks. However, they were interested in the concept and requested that 20 copies of each Monograph and 100 copies of the abstracts be provided to them for a market survey. They later reported that the limited number of responses did not indicate a definite positive or negative acceptance of Monographs as an educational tool.

John Wiley and Sons, Inc. and McGraw-Hill Book Company indicated an interest in the concept but were not optimistic in the acceptance of paperbacks in engineering education. Both organizations were receptive to further discussions. The regional representative of McGraw-Hill Book Company has visited Oklahoma State University on several occasions, once within the past month, to inquire on the progress of the program.

G. EVALUATION

Educational Monographs

Evaluations of Educational Monographs increased from 13 on August 31, 1967 to 159 on August 31, 1968. An additional 6 evaluations were received during September, 1968, bringing the total to 165 effective September 30, 1968. During the last seven months of the period, 136 evaluations were returned by educators and industrial organizations. Figure 2 illustrates the total number of evaluations returned at the end of each quarter of the NASA Pilot Program through August 31, 1968.

The 165 evaluation forms have been returned by 57 professors at 40 universities located in 29 states and 26 practicing engineers in 9 industrial organizations. Of the 165 evaluations, 70 of them contained written comments in addition to the statistical information requested.

In the work statement, it was specified that a minimum of ten evaluations should be provided for each Monograph. Figure 3 illustrates the number of evaluations received for each Educational Monograph. A minimum of ten evaluations has been received on 10 of the documents. It appears that the minimum can be obtained on all the documents when they have been in the hands of the reviewers a sufficient length of time.

The concept of preparing Educational Monographs continues to be favorably received by the individuals requesting the material. For every 11 positive responses to the concept, only one negative response is received. However, as a larger number of evaluations are obtained, it is apparent that some modifications of the material might be desirable to produce the highest quality of the document. A sampling of the positive and negative comments of the 70 evaluators who provided written critiques of the Educational Monographs they reviewed or used are shown below under five headings.

1. ARE MONOGRAPHS A USEFUL METHOD OF PRESENTING NEW TECHNICAL INFORMATION IN THE CLASSROOM UNTIL THE MATERIAL CAN BE INCLUDED IN A TEXTBOOK?

   "....is useful reference material but too confined to one area. Most information, except for graphs, is already in textbooks."

   "Yes, they are...1 - as a basis for a lecture. 2 - as a basis for a student lecture on a particular topic....as I used them I found them as excellent aids to my own as well as student understanding."

   "Much too specific to be useful. The formulas given apply only to very specific situations and are not generally applicable."

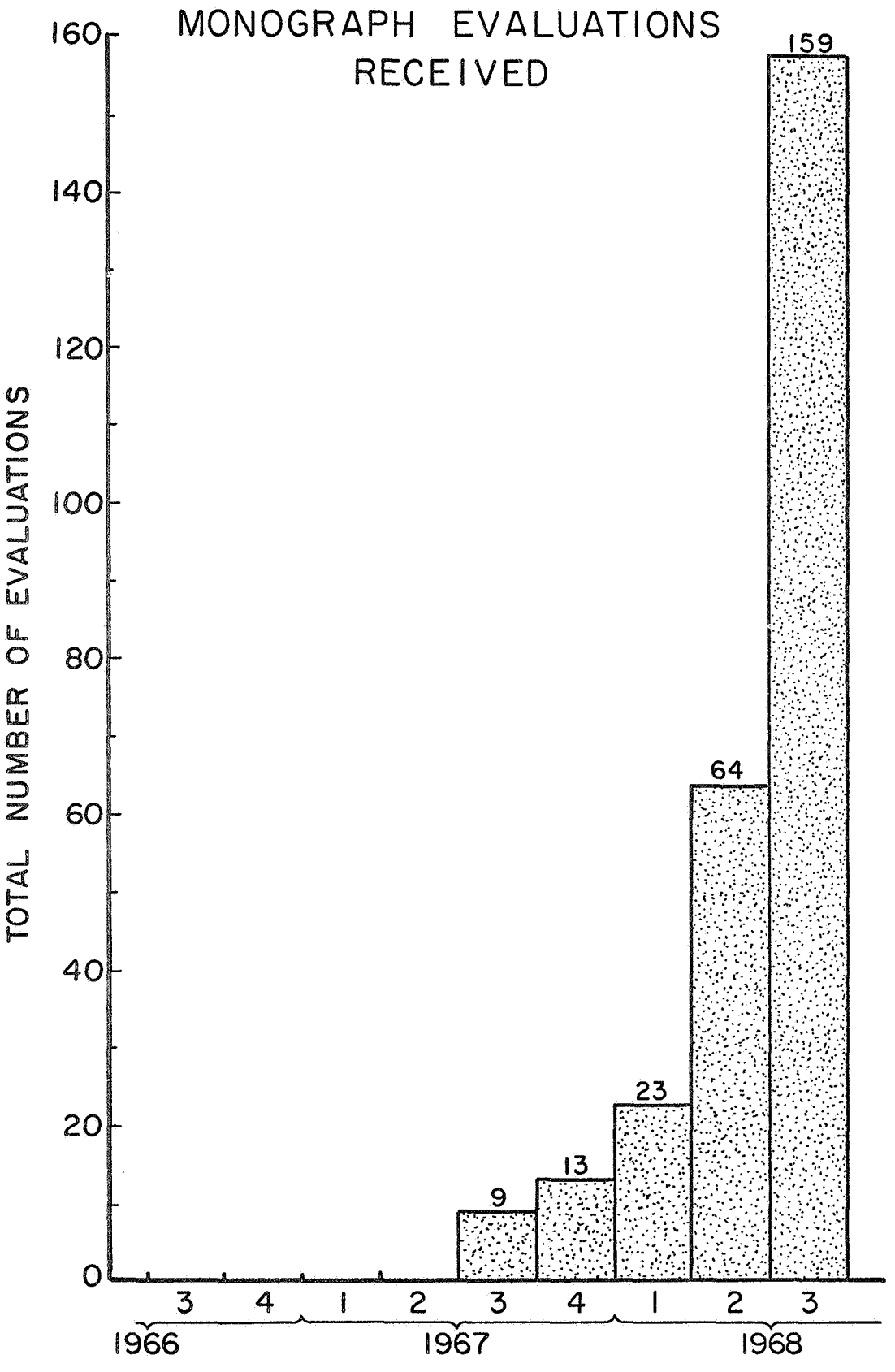
MONOGRAPH EVALUATIONS RECEIVED
TOTAL NUMBER OF EVALUATIONS
160
140
120
100
80
60
40
20
0
9
13
23
64
159
3
4
1
2
3
4
1
2
3
1966
1967
1968

Figure 2

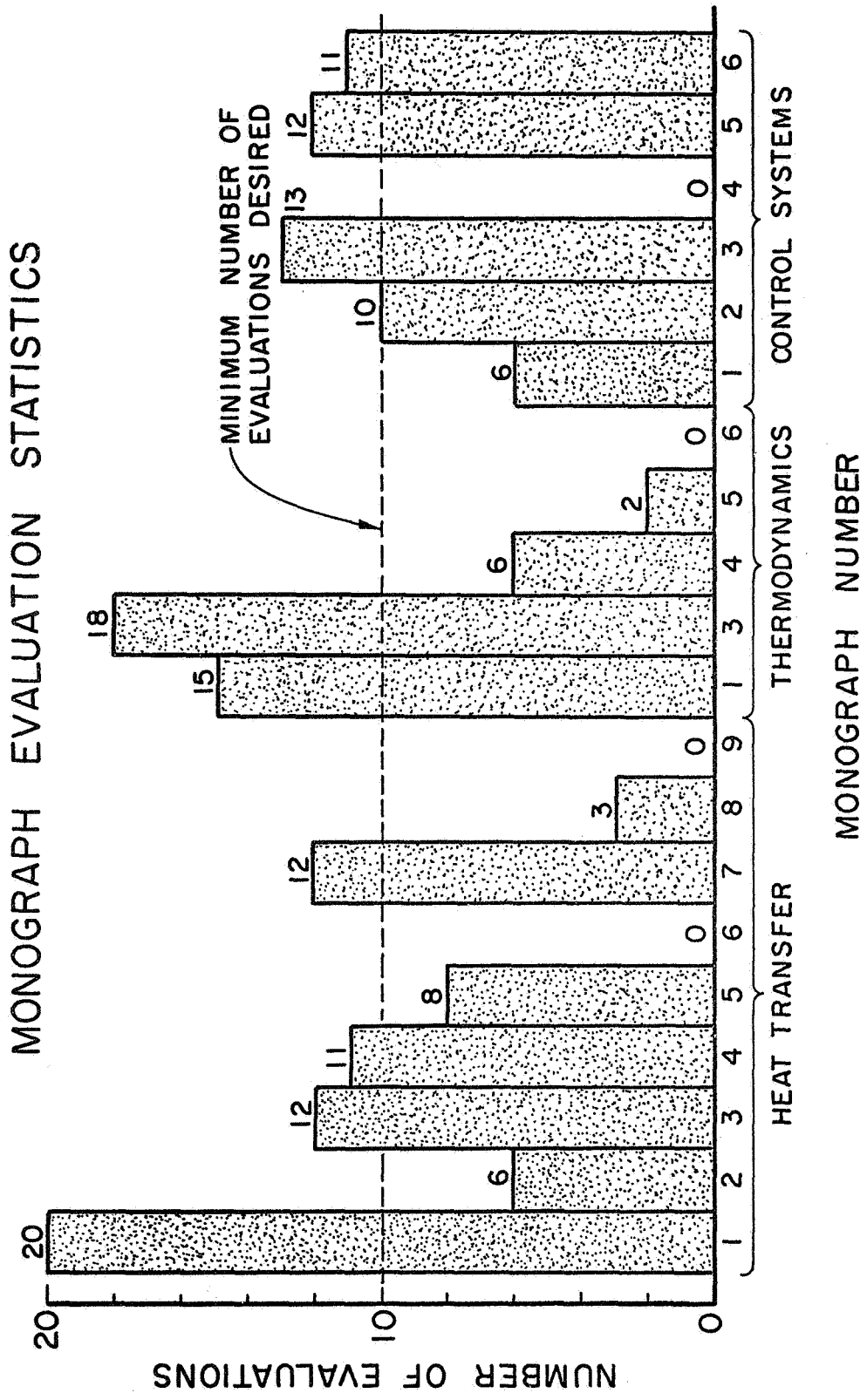
MONOGRAPH EVALUATION STATISTICS
NUMBER OF EVALUATIONS
MINIMUM NUMBER OF EVALUATIONS DESIRED
HEAT TRANSFER
THERMODYNAMICS
CONTROL SYSTEMS
MONOGRAPH NUMBER

Figure 3

". . . monograph series is very beneficial in that it permits the inclusion of timely material in lecture and laboratory courses for both graduates and undergraduates.....The most important aspect of the monograph is that someone is making a systematic search in each of the areas covered and presenting the material to engineering teachers for their use."

"Yes, but it appears some [Monographs] may be too elementary for a graduate class, but also too long or involve some mathematics, techniques or background (junior level) experience. This particular monograph is not in this dilemma."

"This is a useful method of presenting new technical information. However, this particular monograph contained very little new information."

"Monographs could be extremely useful in industry as well as the classroom for keeping engineers abreast of current developments in their field."

"Not good for presenting new material before text coverage. Very good as a practical problem."

". . . is useful in adding to lecture material to indicate the state of the art. It is especially useful in graduate courses work where texts can form the basis for instructors but must be augmented with current outside material."

"Yes, however, it is necessary to be quite detailed if the professor is going to take the time to use them--otherwise the tendency is to stick with what you have becuase of "time problems" in developing new material and filling in the gaps in the monographs."

"Very useful method for engineers in industry to improve or update their skills by self study or study groups. This particular monograph would be difficult to improve upon."

"In my opinion, the monograph was well organized from a technical viewpoint, presenting a sufficient amount of information in a logical sequence. The written presentation is brief and does not distract the reader from the technical information."

"Yes, if written FOR classroom use. The one I got was written more as a technical journal article. It would have required a gread deal of work on my part to have been able to make it useful for an undergraduate course."

"My own opinion of this Monograph is that it is an excellent discussion... I think it is something graduate students should have available to them.... I hope to have the privilege of using another one this coming fall."

"Perhaps I misunderstood the purpose of the Monographs. I thought they would be addressed to bridging the gap between textbook approaches and actual practices... The 4 Monographs I looked at definitely do not do this and appear not to be trying to do this...."

"As a taxpayer, I'd say they aren't worth the price and NASA could well cut it from its budget without jeopardizing Engineering Education. As long as they do exist, I'd like to keep getting them so I can use one once in awhile,... the only real merit to your project would be to the engineering professor with no recent industrial experience, no interest in current technical meetings.... For such a person, your monographs would allow him to give the <u>appearance</u> of being up to date with very little effort on his part."

"As all teachers know, pedagogy is a highly subjective art. We have little solid evidence of what is or isn't good teaching. Thus, my comments below represent my own subjective appraisal. I make this preface, because I favor the kind of experiment you are trying, but do not intend to use the result.

My impression is that in each of the Monographs there was too much detail on one specific item to justify inclusion in the courses we teach. To use the material properly we would have to devote two class days to the subject of a monograph, and probably two nights of homework time. I simply don't believe that the gain from such a process would justify the effort.

My second comment is that the relation of the subjects treated to practical problems (i.e. problems someone will pay to get the answer to) was too sketchy. If it were closer we might have fitted these into a design course, but these would not fit there in their present form.

Neither the university I teach in, nor the one I attended, teaches a course in which the students are expected to do directed reading and problem solving. Instead, we use lecture-recitation. I think we ought to try more of the former, but we don't. If I can ever sell my colleagues on such a course we might use the Monographs as subject matter for part of the course. They are better suited for that than for lecture-recitation."

"In the present form, the Monograph does not offer any new information other than that from the standard textbooks."

2. WHAT ARE GOOD POINTS OF MONOGRAPHS?

"Students were able to follow presentation due to concise notation presented in Monograph."

"Students got acquainted with the real analysis of problems which are confronting engineers who are active now."

"Monographs can discuss specific problems and specific methods which a textbook cannot cover completely."

"Monographs may be developed to supplement textbook and expound information newly developed."

"I feel it had some value to the students as an introduction to current topics."

"Good point is that one subject is treated in some depth."

"Betterapproach than professor giving classroom lecture on material only."

3. ANY IMPROVEMENTS NEEDED?

"I would like to see one or more relatively simple problems based on the material in addition to the ones used."

"Problems should be written which deal with current and future aerospace and outerspace hardware. The theory presented in the Monograph should be better illustrated and applied, via the problems.... In addition to relating the problems to specific hardware, a statement of difficulties and history which led to the problem (such as a practicing engineer might encounter) would stimulate the teaching and learning process."

"Have more monographs so that the instructor can be more selective."

"The background material of a rather general nature may be lacking in both the monograph and the text used in the course. In this case, the undergraduate student must assimilate and associate information from too many sources."

"We would have appreciated greater detail at the level (senior) of the present course--but for grad students this is O.K."

"New materials of this form should confront students with a segment of the current literature--which should be helpful in stimulating research ideas."

"More background material in beginning and example problems."

4. SHOULD A PROGRAM OF PREPARING MONOGRAPHS BE EXPANDED TO OTHER SUBJECT AREAS?

"I would like to see a series of Monographs in kinetics and mass transfer. They should be geared for an undergraduate level."

"I might make some use, but not extensive use. Those which can be used to present a subject in one day are probably the ones I'd consider. I am not searching for material to cover, but trying to decide what I can afford to leave out; I think this is true throughout engineering and not just my subjects or me."

"The program should be expanded. I would use them to the extent that they would fit into the context of the course I am teaching. Due to the difficulty of fitting them in, this would probably result in occasional use, rather than frequent."

"If the other monographs now available (and those contemplated for the future) are of the same character as those examined, I would not be interested in using them."

"Yes, if well written."

"I should like to see others of this same general type."

[Generally, the answer "yes" or "no" was all that was said in answer to this question.]

5. PROBLEMS ENCOUNTERED USING MONOGRAPHS.

"...nomenclature was not the same as used in the course--hence they [students] became confused."

"There were several technical errors in the monograph."

"On this particular monograph, there appears to be an error which affects the conclusion."

"Problem could be reworded for more clarity."

A detailed summary of each Educational Monograph is provided in Appendix XII. This appendix is divided into subsections, one subsection for each Educational Monograph. Each subsection presents the dissemination statistics, evaluation statistics, evaluators written comments, and an analysis for each Educational Monograph ready for distribution.

Visual Briefs

A total of 111 evaluations have been received from the users of the technical films. Figure 4 illustrates the number of evaluations received for each Visual Brief. Originially, a minimum of five evaluations was specified in the work statement as required for each Visual Brief. A total of 13 Visual Briefs have been evaluated by five or more users. The Visual Briefs have been evaluated by 73 professors at 46 universities located in 27 states and 2 foreign countries. The Visual Briefs, like the Monographs, have been received favorably: 10 favorable responses to each unfavorable response. Appendices VIII and IX tabulate all the comments provided by the evaluation sheets.

An analysis of the evaluations indicate a favorable response to the use of the technical films. However, the small number of requests received for their use, as compared to the Educational Monographs, indicates that the Visual Brief has a limited application. The inability to modify the films for educational use appears to be the main disadvantage. For example, there are portions of the Visual Briefs that should be expanded to provide proper instructional material; this is not possible. They could be edited but this has not been necessary. Therefore, Oklahoma State University has used the films without alteration.

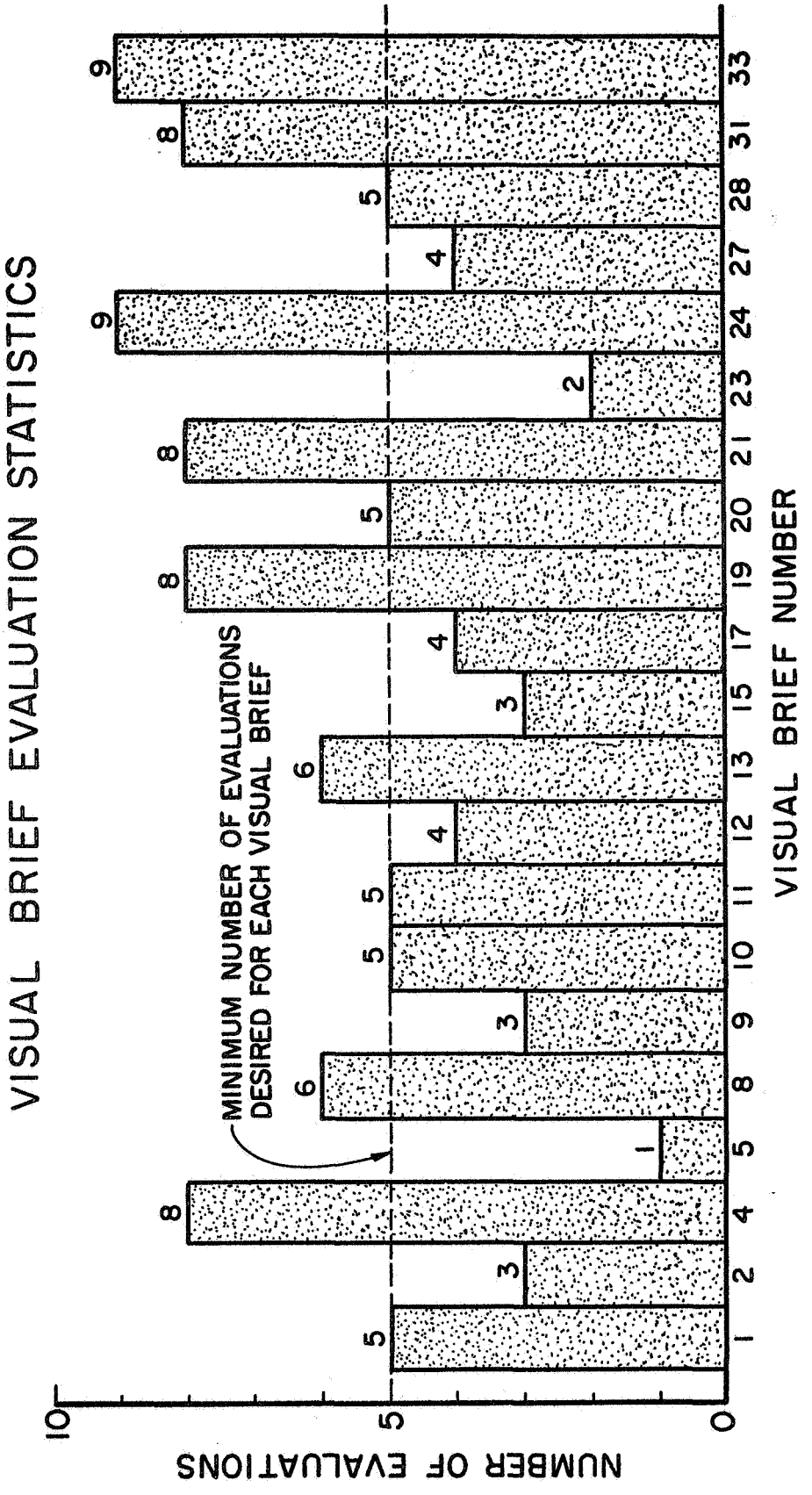
VISUAL BRIEF EVALUATION STATISTICS
NUMBER OF EVALUATIONS
10
5
0
MINIMUM NUMBER OF EVALUATIONS DESIRED FOR EACH VISUAL BRIEF
VISUAL BRIEF NUMBER
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

Figure 4

H. COST OF PROGRAM

This cost summary covers the period June, 1966 through November, 1968. Expenses for November, 1968, are estimated on the basis of past experience and known outstanding expenses.

The following table illustrates the authorized funding, committed expenses and estimated uncommitted funds for the period June, 1966 through November, 1968.

Funding

Authorized Funds	$210,099
Estimated Committed Funds	206,211
Uncommitted Funds	$ 3,888

The NASA Pilot Program was initially conceived as an experiment to evaluate the use of Educational Monographs as supplementary material in engineering classes and as planned self-study material for practicing engineers and scientists. It was recognized initially that important objectives of the program included both the development of the program and the generation of a selected number of Monographs for evaluation.

An analysis of the program and its funding was made to appropriately apportion expenses to the two major categories:

1. Program Development and Administration

2. Educational Monograph Writing

The assigned expenses were based on the experience of the program during the past two years, knowledge of the people and their duties, and an estimated split of general expenses.

The cost of the Monograph authors, graduate students, and secretarial help (for Monograph authors) for the first six months of the program were considered as Program Development and Administration since all program participants were working on the format of documents, methods of obtaining material and procedures to follow.

Tables I and II illustrate the expenses of the program for the 30-month period. Approximately 41% of the total committed funds ($206,211) was expended in Program Development and Administration while 59% of the funds was used in Educational Monograph writing.

An analysis of the Educational Monograph writing expenses shows that the average cost of writing a document was $4,214 for 29 Monographs attempted. Four documents were not completed because of technical problems encountered in developing the material into the educational format.

It is significant to note that the four Educational Monographs written by Professor J. B. Wiebelt and Professor Paul L. Miller were prepared for an approximate average cost of $1,700 per document. This consultant author-senior author mode of writing was very successful economically. This cost experience indicates that a cost of $2,000 per document in future program development and planning is not unrealistic.

COST SUMMARY
NASA Pilot Program
June, 1966 through November, 1968

TABLE I

FUNDING

Authorized Funds	$210,099
Estimated Committed Funds	206,211
	$ 3,888

PROGRAM EXPENSE

	Cost	Percent
Program Development and Administration	$ 84,014.36	40.7
Educational Monograph Writing	122,196.64	59.3
	$206,211.00	100.0

EDUCATIONAL MONOGRAPH WRITING EXPENSE

Average Cost - 29 Monographs	$4,214
Lowest Average Cost - 4 Monographs	1,687
Highest Average Cost- 5 Monographs	6,084

COST SUMMARY
NASA Pilot Program
June, 1966 through November, 1968

TABLE II

PROGRAM DEVELOPMENT AND ADMINISTRATION

	June, 1966 through October, 1968	(Est.) November 1968	Total
Salaries	$ 37,304.02	$ 1,524.00	$ 38,828.02
Consultant	800.00	500.00	1,300.00
VPI	4,000.00		4,000.00
Indirect	18,741.46	843.00	19,584.46
Lia. Ins., Employee Benefits, FICA	1,643.24	168.00	1,811.24
Supplies and Services	6,541.43	500.00	7,041.43
Publication and Reproduction	2,400.00	1,200.00	3,600.00
Communications	500.00	40.00	540.00
Travel	6,345.63	600.00	6,945.63
Freight and Postage	333.58	30.00	363.58
TOTAL	$ 78,609.36	$ 5,405.00	$ 84,014.36

MONOGRAPH WRITING

Salaries	$ 42,152.59		$ 42,152.59
Indirect	21,133.99		21,133.99
Lia. Ins., Employee Benefits, FICA	1,853.02		1,853.02
VPI	39,998.96	4,000.00	43,998.96
Consultant Authors	1,040.00	500.00	1,540.00
Computer	990.18	120.00	1,110.18
Supplies and Services	3,520.00		3,520.00
Publishing and Reproduction	6,057.98	300.00	6,357.98
Communications	363.92		363.92
Postage	166.00		166.00
TOTAL	$117,276.64	$ 4,920.00	$122,196.64
GRAND TOTAL	$195,886.00	$10,325.00	$206,211.00

I. PROGRAM SUPPORT

Proposal ER 68-T-144, entitled "A Center for Creating Educational Monographs in Engineering" was submitted to the National Science Foundation requesting funding for the first two years of a five year development program. On September 5, 1968, Dr. K. A. McCollom, Mr. R. L. Overton, and Mr. M. B. Carpenter, Oklahoma State University,met with Dr. Alfred Borg, National Science Foundation. Dr. Borg informed us the proposal was to be denied. However, Dr. Borg explained that this denial did not prejudice future proposals on the Educational Monograph program. He further explained that another engineering proposal he had received was turned down on the first submittal. This proposal was resubmitted incorporating some of the suggestions made by NSF evaluators and was funded. It is planned to resubmit to NSF a proposal on Educational Monographs during the first quarter of 1969.

Proposal ER 69-T-35, entitled "A Pilot Program in Technology Transfer Through Educational Monographs for Self Study" was submitted to the Army Research Office. A meeting with representatives of the Army Research Office indicated an interest in the proposal. A decision on the proposal is expected about December 1, 1968.

Proposal ER 69-T-39, letter proposal for continuing the NASA Pilot Program supported under NASA Contract No. NSR 37-002-045, was submitted to the National Aeronautics and Space Administration. The proposal would extend the program for a 9 month period, December 1, 1968 through August 31, 1969. The extension of the contract would allow for the further evaluation and development of Educational Monographs as educational tools in engineering classrooms, the further survey of the industrial use of the documents for self-study or industrial seminars, and the preparation of additional Monographs incorporating changes in technique and format based on the experience and evaluations received.

APPENDIX I

RESUMES

CENTER ADMINISTRATIVE PERSONNEL

RESUME KENNETH A. McCOLLOM

ACADEMIC RANK

Assistant Dean, College of Engineering
Professor, School of Electrical Engineering
Oklahoma State University

EDUCATION

1. Ph.D., Electrical Engineering, Iowa State University, 1964.
2. M. S., Electrical Engineering, University of Illinois, 1949.
3. B. S., Electrical Engineering, Oklahoma State University, 1948.

TECHNICAL AREAS OF INTEREST

1. Energy Conversion and Storage
2. Systems
3. Computer Applications
4. Nuclear Reactors
5. Educational Monographs on New Technology

PROFESSIONAL EXPERIENCE

1. Assistant Dean of the College of Engineering and Professor of Electrical Engineering, Oklahoma State University, 1968-present.
2. Research Associate (1962-1964), Ames Laboratory and Institute for Atomic Research, Iowa State University, Ames, Iowa.
3. Instructor (1957-1962), Graduate Extension Courses in Electrical Engineering, University of Idaho.
4. Branch Manager (1957-1962), Phillips Petroleum Company, Idaho Falls, Idaho.
5. Senior Research Engineer (1954-1957), Phillips Petroleum Company, Bartlesville, Oklahoma.
6. Group Leader (1951-1954), Phillips Petroleum Company, Idaho Falls, Idaho.
7. Associate Engineer (1949-1951), Phillips Petroleum Company, Bartlesville, Oklahoma.

RESEARCH EXPERIENCE

1. Research Project on Energy Storage sponsored by five area electric utility companies, Oklahoma State University, 1964-1968.
2. Director, NASA Pilot Program project to produce educational monographs in technology, sponsored by NASA, Oklahoma State University, 1966-Present.
3. Project Leader, Atomic Energy Commission Laboratory to design and install instrumentation and control and activate the Ames Laboratory Research Reactor, 1962-1964.
4. Branch Manager for Instrument Development. Directed 40 technical persons in instrumentation and control support for Atomic Energy Commission, 1960-1962.
5. Section Chief for development of electronic instrumentation for experiments in the Materials Testing Reactor of the Atomic Energy Commission. Directed 15 engineers and technicians, 1957-1960.

RESEARCH EXPERIENCE (Continued) KENNETH A. McCOLLOM

6. Senior Research Engineer, Phillips Petroleum Company. Application of radiation techniques in petroleum and petroleum production research, 1954-1957.
7. Group Leader, for 5 technical men responsible for electronic instrumentation for nuclear physics and for physical measurements for research in nuclear reactors of the Atomic Energy Commission, 1951-1954.
8. Associate Engineer, Phillips Petroleum Company. Instrumentation for the investigation of combustion processes in jet and internal combustion engines, 1949-1951.

TECHNICAL ORGANIZATIONS

1. Institute of Electrical and Electronics Engineers, Senior Member
2. American Nuclear Society
3. Oklahoma Society of Professional Engineers
4. National Society of Professional Engineers
5. American Society for Engineering Education

HONOR SOCIETIES

1. Sigma Xi
2. Eta Kappa Nu
3. Sigma Tau
4. Phi Kappa Phi
5. Phi Eta Sigma
6. Kappa Kappa Psi
7. Omicron Delta Kappa
8. Listed in "American Men of Science"
9. Listed in "Who's Who in Atoms"
10. Listed in "Who's Who in the Southwest"

RECENT PUBLICATIONS

1. "Analysis of Period Instrumentation Operation at Full Reactor Power," presented at the Conference on the Problems of Operating Research and Power Reactors, American Nuclear Society, Ottawa, Canada, October 21, 1963.
2. "Use of Energy Storage with Unconventional Energy Sources to Aid Developing Countries," presented at 1967 Intersociety Energy Conversion Engineering Conference, Miami Beach, Florida (American Society of Mechanical Engineers) August 13-17, 1967.
3. "Monographs Containing Source Material on New Technology," presented at Annual Meeting of the American Society for Engineering Education, Event No. 71.2, Lansing, Michigan, June 19-22, 1967.
4. "Source-Material on New Technology for Engineering Education," presented at Fifth Space Congress, Cocoa Beach, Florida, March 11-14, 1968
5. "Education Enrichment Materials," presented at NASA Conference on Technology Utilization, Langley Research Center, Jampton, Virginia, June 3-5, 1968.

REPORTS

More than 20 published reports mostly in the Atomic Energy Commission report series. Four patents of invention.

RESUME C. A. DUNN

ACADEMIC RANK

Associate Dean Emeritus, College of Engineering
Professor Emeritus of Civil Engineering
Oklahoma State University

EDUCATION

1. Ph.D., Civil Engineering, Cornell University, 1941.
2. M. S., Civil Engineering, Oklahoma State University, 1937.
3. C. E., Civil Engineering, Oklahoma State University, 1934.
4. B. S., Civil Engineering, University of Wisconsin, 1923.

TECHNICAL AREAS OF INTEREST

1. Engineering Education
2. Mechanics
3. Structures

PROFESSIONAL EXPERIENCE

1. Associate Dean, College of Engineering, Oklahoma State University, 1966-present.
2. Director of Engineering Research, College of Engineering, Oklahoma State University, 1945-1966.
3. Administrative Head, School of General Engineering, Oklahoma State University, 1935-1965.
4. Instructor, Assistant Professor, Associate Professor, Professor School of Civil Engineering, Oklahoma State University, 1929-present.
5. Bridge Designer and Construction Engineer, Arkansas Highway Department, 1927-1929.
6. Instrument Man, Assistant Resident Engineer, Resident Engineer on construction of four bridges across Missouri River, South Dakota, 1923-1927.
7. Registered Professional Engineer, Oklahoma.

CONSULTING EXPERIENCE

1. Consultant to City of Perry, Oklahoma.
2. Consultant to Oklahoma Conservation Board.
3. Advisor to Oklahoma Planning and Resources Board.
4. Civilian Observer, Task Force Frigid (Army General Forces), Fairbanks, Alaska.
5. Civilian Observer, Operation Cool School (U.S. Air Force), Newfoundland, Greenland, Alaska, and Canada.

RESEARCH EXPERIENCE

1. Research in electric welding field.
2. Investigation of columns with elastic lateral supports.

PROFESSIONAL AND HONORARY ORGANIZATIONS

1. National Society of Professional Engineers, President, 1958-1959, Vice President, 1956-1958, Oklahoma National Director, 1952-1953.
2. Oklahoma Society of Professional Engineers, President, 1948.
3. American Society of Civil Engineers, President, Oklahoma Section, 1946.
4. American Society for Engineering Education.
5. Oklahoma Education Association.
6. American Association for the Advancement of Science
7. Phi Kappa Phi
8. Sigma Tau
9. Chi Epsilon
10. Phi Alpha Theta
11. Tau Beta Pi

HONORS

1. Fellow AAAS
2. Who's Who in America
3. Who's Who in the Southwest
4. American Men of Science
5. Who's Who in Engineering
6. Who's Who in Education
7. Engineering of the Year, O.S.P.E., 1965

PUBLICATIONS

Author of various engineering technical articles and publications on engineering and industrial research, education, and administration.

RESUME ROBERT L. OVERTON

ACADEMIC RANK

Research Engineer
Office of Engineering Research
Oklahoma State University

ACADEMIC TRAINING

B. S., Industrial Engineering, Oklahoma State University, 1954

TECHNICAL AREAS OF INTEREST

1. Educational Monographs on New Technology
2. Environmental Conditions
3. Electrical Power

PROFESSIONAL EXPERIENCE

1. Research Engineer, Office of Engineering Research, Oklahoma State University, 1967-Present.
2. General Supervisor, San Diego Gas & Electric Company, San Diego, California, 1965-1967.
3. Gas Service Supervisor, San Diego Gas & Electric Company, San Diego, California, 1963-1965.
4. Assistant Engineer, San Diego Gas & Electric Company, San Diego, California, 1959-1963.
5. Junior Engineer, San Diego Gas & Electric Company, San Diego, California, 1954-1959.

RESEARCH EXPERIENCE

1. Deputy Director, NASA Pilot Program project, sponsored by NASA, Oklahoma State University, 1967-present.
2. Research Engineer, Themis Weather Phenomena Project, sponsored by Department of Defense, Oklahoma State University, 1967-present.

TECHNICAL ORGANIZATIONS

1. American Institute of Industrial Engineers, Senior Member.
2. Oklahoma Society of Professional Engineers.
3. National Society of Professional Engineers.
4. American Society for Engineering Education.

APPENDIX II

UNIVERSITY MONOGRAPH DISSEMINATION STATISTICS

APPENDIX II

UNIVERSITY MONOGRAPH DISSEMINATION STATISTICS THROUGH SEPTEMBER 30, 1968

Dissemination Summary by Monograph Number

Monograph Number	Instructor's Copies Sent	Student's Copies Sent	Unfilled Requests Instructor's	Unfilled Requests Student's	Evaluations Received
CS-1	66	248	0	0	4
CS-2	84	576	0	0	9
CS-3	80	486	0	0	11
CS-4	94	345	0	0	0
CS-5	104	413	0	0	10
CS-6	109	467	0	0	10
HT-1	139	513	0	0	15
HT-2	85	179	0	0	5
HT-3	112	526	0	0	12
HT-4	103	484	0	0	11
HT-5	91	176	0	0	6
HT-6	0	0	104	206	0
HT-7	90	174	0	0	6
HT-8	73	350	0	0	2
TD-1	95	363	0	0	10
TD-3	104	352	0	0	11
TD-4	67	188	0	0	6
TD-5	12	2	0	0	1
	1508	5842	104	206	129

APPENDIX III

INDUSTRIAL MONOGRAPH DISSEMINATION STATISTICS

APPENDIX III

INDUSTRIAL MONOGRAPH DISSEMINATION STATISTICS THROUGH SEPTEMBER 30, 1968

Dissemination Summary by Monograph Number

Monograph Number	Instructor's Copies Sent	Student's Copies Sent	Unfilled Requests Instructor's	Unfilled Requests Student's	Evaluations Received
CS-1	22	0	0	0	2
CS-2	15	0	0	0	1
CS-3	35	0	0	0	2
CS-4	33	0	0	0	0
CS-5	25	0	0	0	2
CS-6	31	16	0	0	1
HT-1	37	15	0	0	5
HT-2	20	15	0	0	1
HT-3	30	15	0	0	0
HT-4	25	15	0	0	0
HT-5	41	15	0	0	2
HT-6	0	0	15	15	0
HT-7	66	15	0	0	6
HT-8	49	15	0	0	1
TD-1	31	15	0	0	5
TD-3	69	15	0	0	7
TD-4	24	0	0	0	0
TD-5	30	15	0	0	1
	583	166	15	15	36

APPENDIX IV

SUMMARY OF INDUSTRIAL PROGRAM

SUMMARY OF INDUSTRIAL PROGRAM

The Goddard Space Flight Center survey was to determine the magnitude of interest industrial organizations might have in Educational Monographs. Under contract to the Goddard Space Flight Center Technology Utilization Office, the Office of Industrial Applications of the University of Maryland distributed descriptive information on the Educational Monograph program to corporate heads of 243 industrial organizations.

Four Education Briefs, one page abstracts of the Monographs, were mailed to the companies together with a cover letter explaining the potential of Educational Monographs. The companies were invited to write Goddard Space Flight Center requesting complete copies of the four Monographs to allow detailed evaluation.

The results of the Education Brief Survey was most encouraging. Eighty-nine of the 243 companies responded; 62 of them indicated further positive interest in receiving the complete Monographs. The 62 companies were then mailed all four Educational Monographs after which 17 companies again responded. This small percentage of secondary responses was not considered an indication of non-interest since response time for information of this nature within industrial organizations may be delayed or bypassed depending on the work load of the individuals in the organizations. The conclusions from the survey results were that the industrial community has an interest in the use of Educational Monographs.

Oklahoma State University instituted a follow-on survey for the Goddard survey. Follow-on letters were written to the 17 organizations indicating secondary responses to the Goddard Space Flight Center survey. Two of the organizations have requested additional Educational Monographs. A second follow-on letter was mailed to the 45 companies that indicated an interest in the program but had not made a secondary response. We are awaiting answers to this latest effort.

Oklahoma State University initiated a companion survey which is complementary to the Goddard survey to determine industrial interest in Educational Monographs. Industrial membership in the American Society for Engineering Education was used as a source of dissemination. This group of 205 organizations was selected because of their indicated interest in engineering education. Perhaps more important is that many of the designated representatives are directly involved in the employment, in-house training or supervision of engineers and scientists.

A letter describing the Educational Monograph program was mailed to each of these organizations along with instructor's copies of Monographs CS-1, "An Example of Compensation Network Design"; HT-1, "Calculation of Radiant Heat Exchange by the Monte Carlo Method"; and TD-1, "Calculation of Complex Chemical Equilibria". Several copies of the abstracts of Monographs available for distribution were also attached.

The copies of Educational Monographs were included in the initial mailing to illustrate the format, simplicity of presentation and content. The recipient could immediately route the Monographs to appropriate engineers or scientists for review. Each recipient was asked to evaluate the Educational Monographs for application by industry--for either industrial seminars or for individual study.

Responses to the OSU survey have been gratifying. Of the 205 organizations contacted, 46 had responded by May 17, 1968, and additional responses are expected. Seventy-eight percent of the responses (36 companies) were positive. The other 22% of the replies (10 companies) were considered negative responses. Of the 36 companies responding positively, representatives of 29 companies have requested additional monographs for review. Number of responses received each week are shown in Figure 5. The relationship of positive and negative responses is illustrated in Figure 5. A total of 283 instructor copies and 165 student copies of Educational Monographs have been mailed for industrial use. Individual company requrest have ranged from one copy of one monograph to 66 copies of monographs for use by 21 different engineers.

A comparison of the results of the OSU survey, the Goddard Space Flight Center survey, and the NASA Office of Technology Utilization Tech Brief Mode III dissemination illustrates the acceptance of Educational Monographs by industry. In both the NASA Education Brief survey and the OSU survey responses to initial contact to industry exceeded the response to Tech Brief disseminations: NASA Tech Brief - 21.6% response; OSU Industrial Survey - 22.4% and NASA Education Brief - 36.6%. However, Figure 6 illustrates that the positive response of the Educational Monograph was twice as great as that experienced with the Tech Brief. The positive response on the OSU survey was 10% greater than the response to the NASA Educational Brief survey. This greater response is attributed to the selection of the management level to whom the material was mailed.

The positive response to both the NASA survey and the OSU survey is a good indication that Educational Monographs have a place in the continuing education of industrial employees provided a greater selection of material can be generated to encourage industry to use them frequently.

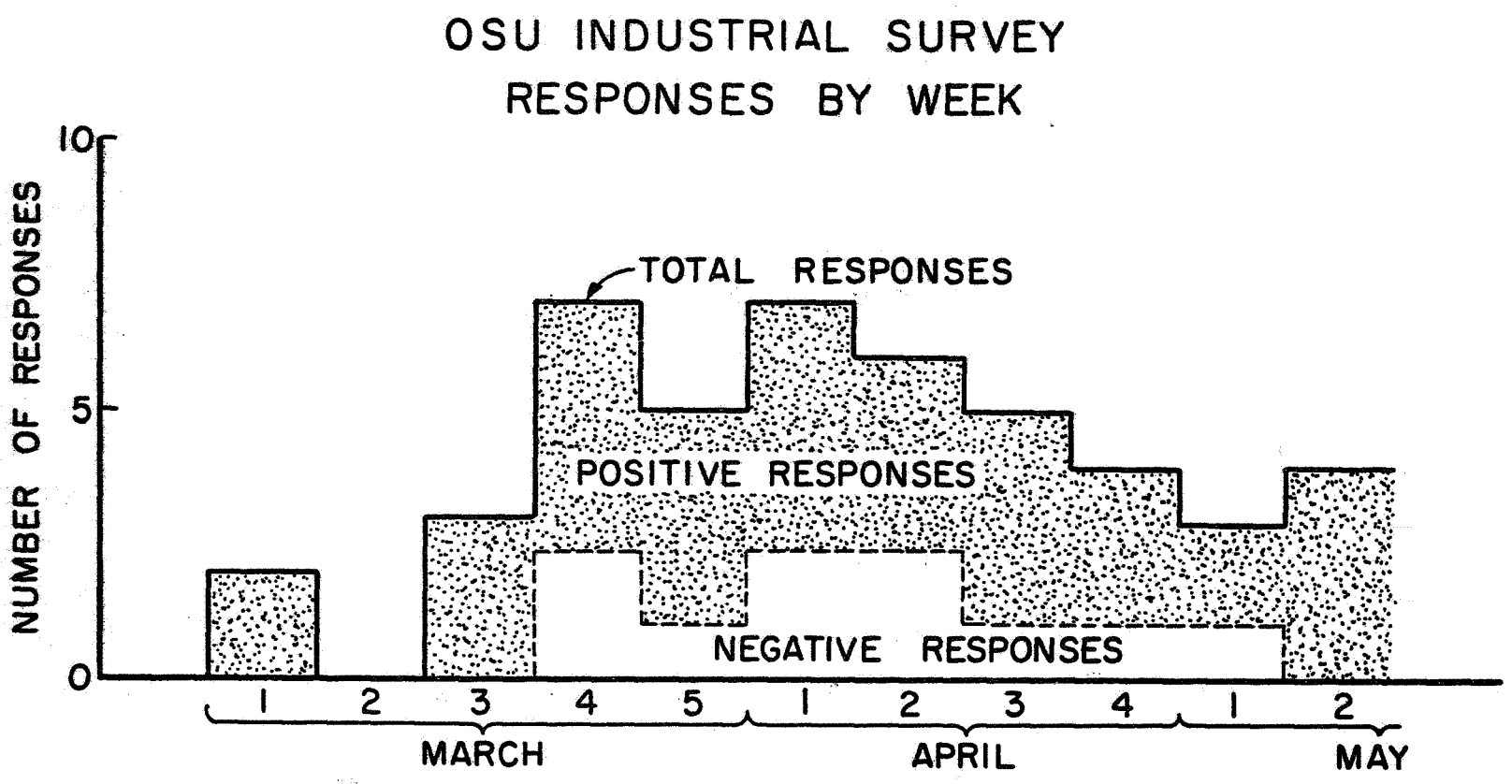
OSU INDUSTRIAL SURVEY
RESPONSES BY WEEK
NUMBER OF RESPONSES
10
5
0
TOTAL RESPONSES
POSITIVE RESPONSES
NEGATIVE RESPONSES
1 2 3 4 5 1 2 3 4 1 2
MARCH
APRIL
MAY

Figure 5

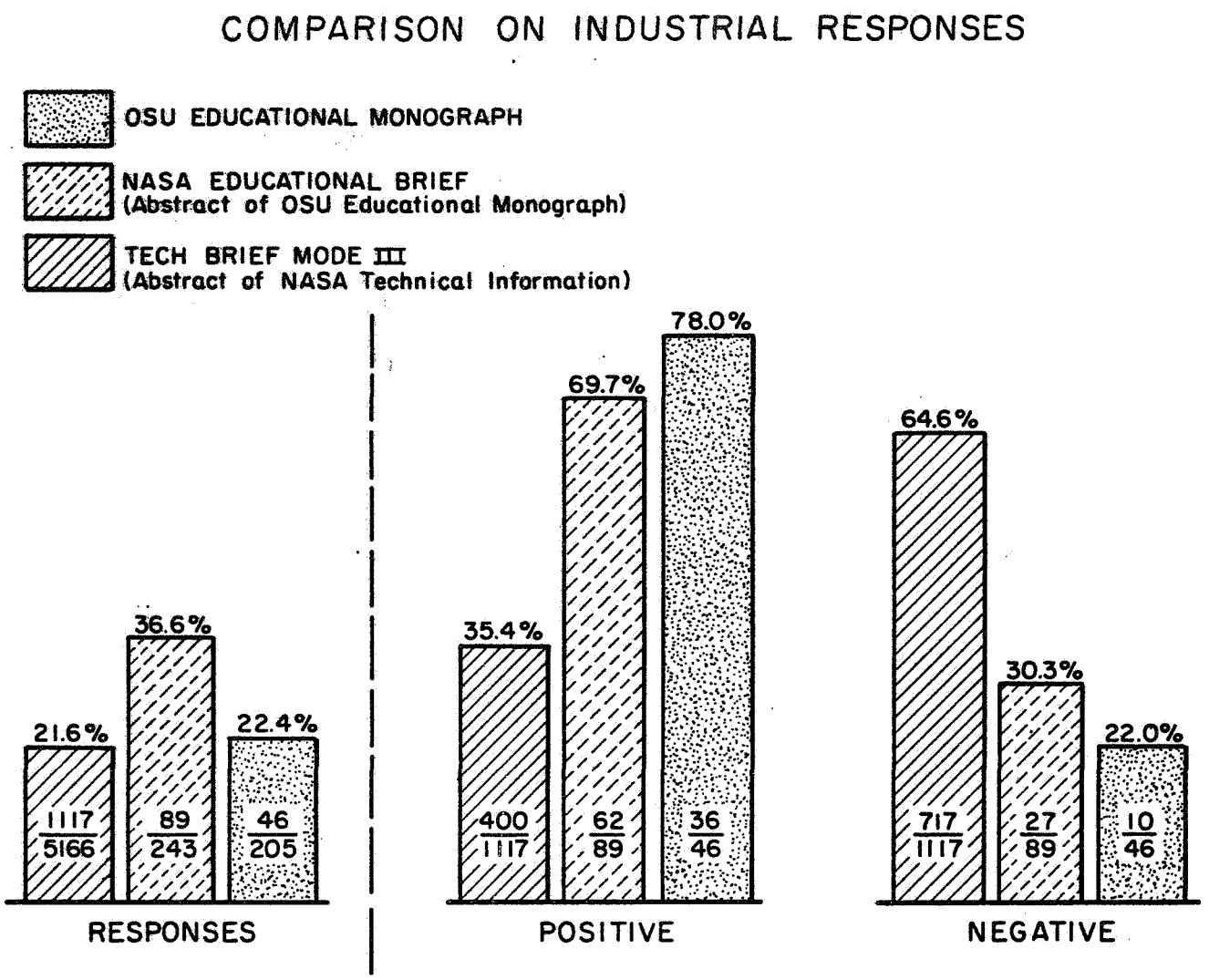
COMPARISON ON INDUSTRIAL RESPONSES
OSU EDUCATIONAL MONOGRAPH
NASA EDUCATIONAL BRIEF
(Abstract of OSU Educational Monograph)
TECH BRIEF MODE III
(Abstract of NASA Technical Information)
21.6%
1117/5166
36.6%
89/243
22.4%
46/205
RESPONSES
35.4%
400/1117
69.7%
62/89
78.0%
36/46
POSITIVE
64.6%
717/1117
30.3%
27/89
22.0%
10/46
NEGATIVE

Figure 6

APPENDIX V

ADVERTISEMENT IN ASEE JOURNAL

ENGINEERING INSTRUCTIONAL MATERIAL

- NEW APPLICATIONS OF KNOWN PRINCIPLES
- NEW METHODS OF SOLVING PROBLEMS

NASA

MONOGRAPHS AND VISUAL BRIEFS FURNISHED FREE TO ENGINEERING EDUCATORS

MONOGRAPHS AND VISUAL BRIEFS HAVE BEEN PREPARED FROM NASA RESEARCH TO EVALUATE THEIR EFFECTIVENESS IN PROVIDING ENGINEERING EDUCATORS WITH NEW ENGINEERING AND SCIENTIFIC MATERIAL PRIOR TO ITS INCLUSION IN TEXT BOOKS

MONOGRAPHS

Monographs are designed to provide supplementary material in graduate or advanced undergraduate heat transfer, thermodynamics, and control systems courses. They require from one to three hours lecture time without undue research by the instructor. Instructor and student copies are furnished free.

VISUAL BRIEFS

These technical films provide visual information not readily presented in written material. Subject areas are: Heat transfer, gas dynamics, machine design, reaction kinetics, aircraft structures, control systems, and bioelectronics. Visual Briefs are furnished on a no fee, loan basis.

FOR FULL DETAILS, WRITE OR SEND THIS COUPON TO:

Dr. Kenneth A. McCollom
NASA Pilot Program
College of Engineering
Oklahoma State University
Stillwater, Oklahoma 74074

Name .....
Department .....
School .....
Address .....
City ..... State .....

College of Engineering — Oklahoma State University

APPENDIX VI

ABSTRACTS OF EDUCATIONAL MONOGRAPHS

MONOGRAPH ABSTRACT

HT-1 Calculation of Radiant Heat Exchange by the Monte Carlo Method

HT-2 A Generalized Correlation of Vaporization Times of Drops in Film Boiling on a Flat Plate

HT-3 Method for Estimating Ratio of Absorptance to Emittance

HT-4 Formulas for Radiant Heat Transfer Between Nongray Parallel Plates of Polished Refractory Metals

HT-5 Pool Boiling Heat Transfer at Reduced Gravity

HT-7 The Method of Zones for the Calculation of Temperature Distribution

HT-8 Heat Pipes and Vapor Chambers for Thermal Control of Spacecraft

TD-1 Calculation of Complex Chemical Equilibria

TD-2 Thermodynamic Equations, Data and Techniques for Preparing Properties Compilations

TD-3 Critical Flow of Real Gases Through Nozzles

TD-4 Thermodynamic Consistency of Vapor-Liquid Solubility Data

TD-5 Computer Program for Thermodynamic Performance of Brayton Cycle Space Power Systems

TD-6 Enthalpies of Co-existing Equilibrium Vapor and Liquid Mixtures from Solubility Data and Equation of State Calculations

TD-8 Thermodynamics of Space Flight

CS-1 An Example of Compensation Network Design

CS-2 An Application of Root Locus Techniques to Lunar Vehicle Control

CS-3 An Example of Nuclear Rocket Control Design

CS-4 An Example of Bang-Bang Control System Design

CS-5 Controller Design for Nonlinear and Time-Varying Plants

CS-6 An Example of Optimal Control Design

CS-7 An Example of Gain Insensitive Design by State Variable Feedback

CS-8 Synthesis of Minimal Sensitivity Sampled-Data Control Systems

MONOGRAPH HT-1

ABSTRACT

Title: Calculation of Radiant Heat Exchange by the Monte Carlo Method

By: John A. Wiebelt, Mechanical Engineering, Oklahoma State University

The Monte Carlo Method of solving radiant heat transfer problems basically consists of following groups of photons around through a system until they are either absorbed or lost. By using a large number of photon groups the statistical behavior of the large group will approach the behavior of an actual system. This Monograph discusses the technique required to select photon groups, such that a given statistical distribution will be achieved. An example problem is included, which shows how the Monte Carlo technique can be used to solve problems where energy is emitted and reflected in a non-diffuse or non-specular method. In particular it is assumed that the Fresnel type surface is present. The Fresnel surface distribution is used as an example problem.

MONOGRAPH HT-2

ABSTRACT

Title: A Generalized Correlation of Vaporization Times of Drops in Film Boiling on a Flat Plate

By: Kenneth J. Bell, Chemical Engineering, Oklahoma State University

A dimensionless correlation for the vaporization times of discrete liquid masses in the Leidenfrost state is obtained and verified with experimental data in the literature. The correlation is presented as a single curve volume. The correlation works well for the entire range of initial liquid volumes from spherical drops to large pancaked blobs.

MONOGRAPH HT-3

ABSTRACT

Title: Method for Estimating Ratio of Absorptance to Emittance

By: John A. Wiebelt, Mechanical Engineering, Oklahoma State University

A graphical method is presented for estimating the values of the ratio of absorptance to emittance α/ε that can be achieved with surfaces having a high degree of spectral selectivity. The ratio of emitting source to absorbing surface temperature is the parameter in the graphs. In principle, the results of the calculations presented are general and apply for any source or surface temperature. In practice, the ratios of absorptance to emittance so estimated can be used in radiant heat transfer calculations involving space vehicles. In this case α becomes α_s the total normal absorptance of a surface to solar radiation, and ε the total hemispherical emittance.

MONOGRAPH HT-4

ABSTRACT

Title: Formulas for Radiant Heat Transfer Between Nongray Parallel Plates of Polished Refractory Metals

By: John A. Wiebelt, Mechanical Engineering, Oklahoma State University

Hemispherical emittance, both total and normal, were calculated from normal spectral-emittance data. The metals evaluated were clean polished tungsten, molybdenum, and tantalum, each of which exhibits spectral emittances that vary considerably with temperature and wavelength.

Net radiant heat flow between two parallel infinite plates was computed by summing the monchromatic energy exchange. The evaluation was made for all nine possible combinations obtained by interchanging metals on the two surfaces. The results are graphically presented as a function of temperatures of the two surfaces. Equations of the form

$$q = a(T_1^b - T_2^b)\ \left(\frac{T_2}{T_1}\right)^c$$

were fitted to each of the nine sets of heat flux calculations, where q is the heat transfer rate, and T_1 and T_2 are the temperatures of the hotter and cooler surfaces, respectively. Values of the constants, a, b, and c are presented along with contour plots showing the temperature regions in which the equations are accurate. A comparison with conventional calculation techniques is presented.

MONOGRAPH HT-5

ABSTRACT

Title: Pool Boiling Heat Transfer at Reduced Gravity

By: Kenneth J. Bell, Chemical Engineering, Oklahoma State University

The role of gravity in the theory of nucleate and film pool boiling mechanisms is examined and compared to experimental results. Particular attention is given to the critical heat flux and interface stability. Bubble growth and dynamics in reduced gravity fields are also considered.

MONOGRAPH HT-7

ABSTRACT

Title: The Method of Zones for the Calculation of Temperature Distribution

By: Paul L. Miller, Mechanical Engineering, Kansas State University
John A. Wiebelt, Mechanical Engineering, Oklahoma State University

The method of zones is an improved method for obtaining approximate solutions to certain partial differential equations. The application of this method of heat transfer problems is discussed in detail. The method of zones assumes the temperature in the zone of interest varies parabolically with the space coordinates. Volume integrated mean temperatures are used as the "zone temperature" and area integrated mean temperatures are used as the "surface temperatures" at the boundaries of the zone. The higher order of approximation of the method permits a complicated system to be divided into fewer parts than is necessary when conventional linear approximation methods are used.

The heat flow equation is integrated over the volume of the zone to give an instantaneous heat balance equation which involves the fluxes over the boundaries of the zone and the rate of change of the volumetric mean temperature of the zone. Approximate formulas, which are based on the parabolic assumption, are derived which express the boundary heat flow rates in terms of the volumetric mean temperature of the zone and the mean temperatures over the zone boundaries. These simultaneous equations in temperature, one for the zone and one for each boundary, are integrated numerically to obtain the temperature as functions of time.

The integration is a two-point integration involving an integration parameter. Rules for choosing this parameter to insure stability and accuracy are given. A rule is also given for selecting the time increment, and the methods for selecting the zone size are discussed.

MONOGRAPH HT-8

ABSTRACT

Title: Heat Pipes and Vapor Chambers for Thermal Control of Spacecraft

By: Paul L. Miller, Mechanical Engineering, Kansas State University
John A. Wiebelt, Mechanical Engineering, Oklahoma State University

This Monograph reviews the basic theory and application of devices that transfers heat by evaporation of liquid from heated areas and condensation on cold areas, with continuous return of the condensate to the heating area by capillary action. Computed examples are presented to indicate possible applications to the solution of thermal control problems and to illustrate the principles and methods of analysis. Items discussed include wicks and associated capillary structures for optimum transfer of heat and minimum resistance to fluid flow.

MONOGRAPH TD-1

ABSTRACT

Title: Calculation of Complex Chemical Equilibria

By: K. C. Chao, Chemical Engineering, Oklahoma State University

Calculation of chemical equilibria in a complex reaction system is carried out in an iterative manner on computers. For this purpose the basic equations expressing the equilibrium conditions are arranged systematically. The equations are linearized. The linearized equations are applied first to the case of a homogeneous ideal gas mixture and then extended to more complex situations.

MONOGRAPH TD-2

ABSTRACT

Title: Thermodynamic Equations, Data and Techniques for Preparing Properties Compilations

By: Wayne C. Edmister, Chemical Engineering, Oklahoma State University

Alternate equation of state methods for calculating the enthalpies and entropies of pure real substances in the preparation of thermodynamic properties compilations, are presented in this Monograph. Four pressure-explicit equations of state are used as bases for the derivations, namely; Redlich-Kwong, Benedict-Webb-Rubin, Modified Benedict-Webb-Rubin, and the Virial Equation of State. These equations provide the relationships for calculating the isothermal effects of pressure on the enthalpy and the entropy and also the molal volumes or densities. Calculations were made for the enthalpy and entropy values of nitrogen, using the Redlich-Kwong relationships and these results were compared with similar results obtained by another via the Modified B-W-R Equations. Ideal gas state heat capacities and the properties of coexisting vapor and liquid were included in this work.

MONOGRAPH TD-3

ABSTRACT

Title: Critical Flow of Real Gases Through Nozzles

By: Wayne C. Edmister, Chemical Engineering, Oklahoma State University

Methods for calculating the mass flow of real gases through critical-flow nozzles are presented by: (1) equation derivations, (2) tabulations of thermodynamic properties for critical flow conditions of steam, (3) problem on application of tabulated date in thrust calculation, and (4) problem on evaluation of critical flow thermodynamic properties of a fluid represented by the Redlich-Kwong equation of state.

MONOGRAPH TD-4

ABSTRACT

Title: Thermodynamic Consistency of Vapor-Liquid Solubility Data

By: Wayne C. Edmister, Chemical Engineering, Oklahoma State University

Methods for testing the thermodynamic consistency of vapor-liquid solubility data with other properties are presented for binary systems. Derivations of the equations for testing isothermal solubility data with densities of the coexisting phases are given, as are the equations for testing isobaric data with enthalpies of the coexisting phases. The isothermal case is illustrated for the Hydrogen-Helium system.

MONOGRAPH TD-5

ABSTRACT

Title: Computer Program for Thermodynamic Performance of Brayton Cycle Space Power Systems

By: John A. Wiebelt, Mechanical Engineering, Oklahoma State University

This Monograph presents a computer program to be used in the calculation of the thermodynamic performance of one and two shaft Brayton cycle space power systems. The systems which can be analyzed include those with or without reheating, with or without intercooling and with or without turbine coolant flow.

Inputs required for the program include the component performance parameters and cycle temperature variables. Output from the program includes cycle efficiency and prime radiator area, and other cycle parameters.

MONOGRAPH TD-6

ABSTRACT

Title: Enthalpies of Coexisting Equilibrium Vapor and Liquid Mixtures from Solubility Data and Equation of State Calculations

By: Wayne C. Edmister, Chemical Engineering, Oklahoma State University

Methods for calculating the enthalpies of the saturated vapor and liquid phases of mixtures are presented theoretically and illustrated on the helium-hydrogen system, using previously published pressure-temperature-composition experimental data for the coexisting equilibrium vapor and liquid phases. An enthalpy-composition diagram is prepared for the helium-hydrogen binary at 400 psia using the results obtained in this example. Differential and integral forms of the isobaric Gibbs-Duhem equation were two of the methods used with the experimental temperature composition data for the binary mixture.

MONOGRAPH TD-8

ABSTRACT

Title: Thermodynamics of Space Flight (Heat Transfer Phenomena in Space)

By: P. L. Miller, Mechanical Engineering, Kansas State University
J. A. Wiebelt, Mechanical Engineering, Oklahoma State University

The analysis used in determining energy gains or losses to spacecraft in orbit is discussed. This is the basic environment parameter type approach without detailed discussion of the heat transfer problem. The Monograph discusses some practical as well as theoretical aspects.

MONOGRAPH CS-1

ABSTRACT

Title: An Example of Compensation Network Design

By: W. A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute
L. L. Grigsby, Electrical Engineering, Virginia Polytechnic Institute

This Monograph gives the design criteria for wide-band phase realization. The design of lattice phase equalizers, all-pass networks that correct the phase response of a system without affecting its amplitude response, are introduced. These equalizers are used to obtain particular phase vs. frequency characteristics which are desirable for phase correction in a wide variety of systems.

MONOGRAPH CS-2

ABSTRACT

Title: An Application of Root Locus Techniques to Lunar Vehicle Control

By: William A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute
Leonard L. Grigsby, Electrical Engineering, Virginia Polytechnic Institute

This Monograph illustrates the use of the root locus technique as an aid to the design of a portion of the control complex of the steering mechanism of a 4-wheel lunar-surface vehicle. Examples of root loci for different steering control systems are presented and compared as to suitability for use in the lunar-surface vehicle with a human operator.

MONOGRAPH CS-3

ABSTRACT

Title: An Example of Nuclear Rocket Control Design

By: William A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute
H. F. vanLandingham, Electrical Engineering,Virginia Polytechnic Institute

A technique which provides a practical compromise between system complexity and speed of response for a large class of systems is discussed in this Monograph. The method is illustrated by an example of its application to a nuclear rocket control problem.

MONOGRAPH CS-4

ABSTRACT

Title: An Example of Bang-Bang Control System Design

By: William A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute
A. Wayne Bennett,Electrical Engineering, Virginia Polytechnic Institute

This Monograph discusses a technique for the systhesis of a Bang-Bang Control System. The technique employs linear switching logic and uses time-dependent gains to eliminate endpoints. For illustrative purposes, the technique is applied to the attitude control of a spinning space vehicle.

MONOGRAPH CS-5

ABSTRACT

Title: Controller Design for Nonlinear and Time-Varying Plants

By: William A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute
H. F. vanLandingham, Electrical Engineering, Virginia Polytechnic Institute

This Monograph discusses a technique to generate a control signal which forces the state of a nonlinear plant to be close to the state of a reference model. The method is suitable for a broad class of nonlinear plants. Special emphasis is placed on the time response to perturbations for equilibrium.

MONOGRAPH CS-6

ABSTRACT

Title: An Example of Optimal Control Design

By: William A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute
A. Wayne Bennett, Electrical Engineering, Virginia Polytechnic Institute

This Monograph discusses a technique for the design of minimum energy descrete-data control system. The "derived" matrix is used to determine a control sequence that will take the state of the plant from some initial state to a desired final state in N sampling periods. The cost function is a time weighted function of the control energy.

MONOGRAPH CS-7

ABSTRACT

Title: An Example of Gain Insensitive Design by State Variable Feedback

By: L. L. Grigsby, Electrical Engineering, Virginia Polytechnic Institute
W. A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute

This Monograph illustrates the use of state variable feedback to design a feedback controller for a linear time-invariant plant in a manner such that the system response is insensitive to gain variations in a linear gain block preceding the plant. The design procedure is developed and applied to the design of the controller for a third-order plant.

MONOGRAPH CS-8

ABSTRACT

Title: Synthesis of Minimal Sensitivity Sampled-Data Control Systems

By: L. L. Grigsby, Electrical Engineering, Virginia Polytechnic Institute
W. A. Blackwell, Electrical Engineering, Virginia Polytechnic Institute

This Monograph gives the development of a procedure for the design of a minimal sensitivity deadbeat sampled-data control system. This procedure is an extension of the usual z transform deadbeat design procedure. The design procedure is illustrated by two examples.

APPENDIX VII

VISUAL BRIEF DISSEMINATION STATISTICS

APPENDIX VII

VISUAL BRIEF DISSEMINATION STATISTICS THROUGH SEPTEMBER 30, 1968

Dissemination Summary by Visual Brief Number

Visual Brief Number	Number Sent	Unfilled Requests	Evaluations Received
VB-1	9	0	5
VB-2	5	1	3
VB-4	18	6	8
VB-5	11	0	1
VB-8	15	9	6
VB-9	9	1	3
VB-10	18	2	5
VB-11	9	1	5
VB-12	14	4	4
VB-13	20	8	6
VB-15	10	1	3
VB-17	9	0	4
VB-19	16	0	8
VB-20	9	1	5
VB-21	10	2	8
VB-23	5	0	2
VB-24	17	0	9
VB-27	9	0	4
VB-28	9	0	5
VB-31	15	0	8
VB-33	13	0	9
	250	36	111

APPENDIX VIII

RESPONSES

VISUAL BRIEF EVALUATIONS

APPENDIX VIII

Totaled Responses on a Revised Visual Brief Evaluation Sheet

General Information on Visual Briefs:

Was the technical information covered in the Visual Brief of value in course presentation?	Yes	31
	No	7
Should the Visual Brief include more information than was presented?	More	22
	Same	20
	Less	3
Would the Visual Brief be more useful if the accompanying report material had been prepared specifically for a classroom lecture?	More	21
	Same	17
	Less	2
Would the material shown on the film be more effective if edited and condensed?	Yes	13
	No	26
Does the inconvenience of obtaining a projector for a classroom lecture affect the frequent use of technical movies?	Yes	7
	No	36

Comments on Use of Visual Briefs:

In what situation was the Visual Brief used? _____

Did the instructor read the documents accompanying the Visual Briefs before the film was used?	Yes	28
	No	15
Was the Visual Brief used in context with closely related material?	Yes	21
	No	17
Did the Visual Brief present the effect well and contribute to the further understanding of the participants?	Well	20
	Fair	11
	Poor	7
Would the Visual Brief be more useful for educational purposes outside the classroom?	Yes	13
	No	23
Could the subject matter have been as easily presented without the visual matter?	Yes	6
	No	34
Would you use this Visual Brief again in an educational situation?	Yes	30
	No	11

APPENDIX IX

COMMENTS

VISUAL BRIEF EVALUATIONS

APPENDIX IX

Comments on Questions Asked on Revised Visual Brief Evaluation Sheet

IN YOUR OPINION, ARE VISUAL BRIEFS A USEFUL AND DESIRABLE METHOD OF PRESENTING NEW TECHNICAL INFORMATION IN THE CLASSROOM?

VB-1: Smoke Trail Wind Shear Measurements

From the point of view of teaching courses in a fundamental way, my opinion is that the Visual Briefs are useful and desirable insofar as they are helpful in demonstrating basic phenomena in a well defined manner. Of course, technical information presentation by movie can be useful if it is directly relevant to the course objectives. (Case Western Reserve University)

This brief was interesting, but not directly applicable to classroom subjects. (University of Wisconsin)

VB-2: Hydrodynamic Rotating Shaft Seals

Helpful to those familiar with the basic subject matter. Well prepared. (Ingersoll Rand Company)

The film was not shown to a class but was reviewed for possible future classroom use. However, since we have demonstration units of the type shown in the film, we do not need this particular film for classroom use. As a matter of interest--we had demonstration units of the type shonw in the film long before the filmed units were conceived. (University of California at Berkeley)

This VB was very well done and since the application is a dynamic one, non-moving presentations could not compare. (Cleveland State University)

VB-4: Bubble Dynamics for Nucleate Boiling in Reduced Gravity

I am afraid that not enough people are aware of the existence of these excellent teaching aids. (North Carolina State University)

This subject of boiling is much easier to describe by visual methods, as in motion pictures, than by written material or still photographs. This movie was very good. (University of Pittsburgh)

This brief is quite good. (Utah State University)

VB-8: Flight Measured Control Power and Damping Required for VTOL Aircraft

The Visual Briefs should include more information of technical nature. This Brief was interesting, but it included very little information on the control system. (University of Arkansas)

This brief had no sound, and the barest minimum of information was given in subtitles. More information as to the physical meaning of the vehicle maneuvers presented would have made this brief much more useful. (North Carolina State University)

VB-9: Pool Heating of Liquid Hydrogen Over a Range of Accelerations

Visual Briefs are helpful for special lectures. This film was off the topic but was useable. (North Dakota State University)

VB-10: Visualization Studies of Combustion Instability in a Hydrogen-Oxygen Model Combustor

It is very useful to use movies on technical material such as this Visual Brief. Often universities cannot afford to obtain all the necessary equipment for research or class experiments in a particular subject, and the movies can aid the student in visualizing material presented in class. (University of Texas)

VB-11: Transonic Buffeting of Hammerhead Launch Vehicles

Visual Briefs are a useful and desirable method of presenting new technical information in the classroom because more information is presented in the brief time that the film takes to run. By reading the accompanying documents that were sent with the brief it was possible to prepare the students for what they say in the film. (Tennessee Technological Institute)

Yes. The visual brief is good enough for the information of the movies in consideration, however, the documentary material should be more complete and more comprehensive. (West Virginia University)

VB-12: Experimental Observations of Transient Boiling in Subcooled Water and Alcohol

The brief was used as a part of the above course, however, the film was shown at a separate session in order that other interested students and faculty could see it. (North Carolina State University)

After previewing it was decided the film was not what was needed, and was not shown to the class. (Utah State University)

VB-13: A Visual Study of Two Phase Flow in a Vertical Tube with Head Addition

Very good. (University of Pittsburgh)

We got these to see what kind of material you had to offer. I do not think this one or the other one will fit nicely into any of our course offerings, but they do make good supplementary material. (University of Utah)

VB-17: Expansion Tube Hypersonic Test Facility

Yes, classroom is good place as any. (Rose Polytechnic Institute)

VB-19: Experimental Research in Aerospace Structural Dynamics

Very useful when supplemented by addition comments by instructor. (North Dakota State University)

Yes. Generally superior to other techniques. (University of Oklahoma)

Yes. The Visual Brief is good enough for the information of the movies in consideration, however, the documentary material should be more complete and more comprehensive. (West Virginia University)

A very definite aid. Gives a good picture of real system problems arising from flexible design structures. Shows that the system designer must consider more than one phase of a complete system and look at the total picture. (Tennessee Technological Institute)

This Visual Brief was desirable in that it presented pertinent material succinctly, and its effect is to emphasize and make realistic classroom presentation. (University of Florida)

VB-20: Magnetically Supported Superconducting Spherical Gyro

Yes (Hudson Valley Community College)

Visual Briefs are a useful and desirable method of presenting new and technical information in the classroom; however this brief was too advanced for the intended audience and projected upside down and backwards. (Tennessee Technological Institute)

VB-21: The Supersonic Transport in the Air Traffic Control System

Yes. The current nature and extensiveness of the problem presented expands student outlook. He gains a realization of the complexity of modern day problems which are hard to get across during a lecture. (Oregon State)

The Visual Briefs would be more valuable if they included more information about design, analysis, etc. (University of Arkansas)

Loan was also requested by a Civil Air Patrol Unit to show at an air show. (University of Virginia)

VB-23: Hypergolic Propellant Research

This was a difficult phenomena to show on a movie. (University of West Virginia)

The idea is a good one but material needs better organization and abstraction. Movies need more "on film" explanation (either titles or sound). Use of this material should be rather difficult for someone not well-acquainted with the problem. (University of California)

VB-27: Flammability of Surface in Zero Gravity

Sound would be desirable for this presentation. (North Dakota State University)

VB-28: Journal Bearings in Laminar and Turbulent Regimes

Yes, they are a good idea. This was too brief, in the sense that explanation of phenomena and parameters was inadequate. Sound films in which the material is competently discussed and commented upon are, in my opinion, much more effective. (University of Pennsylvania)

VB-33: Saturn Radiation and Convection Base Heating

Very good, but too advanced. (University of Calgary)

These Films would be better with sound on the track and more explanation on the film. (West Virginia University)

This particular brief was not useful. A sound track and audio description is a must. (U.S. Naval Academy)

This Brief suffered from two faults (1) No sound--hard to tell what is going on at all times (2) The objective of the Brief -- heat transfer-- is very difficult to visualize. Its effect is not shown clearly by film. (University of Wisconsin)

Brief was used as an introduction to the space-age need for radiation heat transfer analysis. (University of Virginia)

APPENDIX X

WORK STATEMENTS

PREFACE

The two work statements included in this appendix cover the present contract life of the NASA Pilot Program.

---Work Statement I - Initial Contract Period:
June 6, 1966, through August 31, 1967.

---Work Statement II - Second Contract Period:
September 1, 1967, through November 30, 1968.

The Work Statement for the Second Contract Period was prepared when the contract was extended beyond the initial period of 15 months.

SCHEDULE

ARTICLE I

STATEMENT OF WORK

The objective of this pilot program is to test the feasibility of introducing into graduate and advanced undergraduate engineering school curricula educational enrichment materials resulting from space generated research and development.

The program contains two distinct elements, each of which has the common purpose of enhancing the quality of engineering education. These are the Monograph and Visual Brief.

The Contractor shall provide the necessary personnel, equipment and facilities and perform all necessary services required for the preparation, distribution and evaluation of educational enrichment materials as described in detail below.

A. Educational Monographs:

1. The Contractor shall make use of his own resources together, as needed, with those of the Technology Use Studies Center at Southeastern State College in Durant, Oklahoma to locate source materials for monographs.

2. (a) Source materials selected shall include NASA technical reports and they shall cover a topic within one of the three subject areas, Heat Transfer, Thermodynamics, and Control Systems. If a topic that falls outside the foregoing subject areas is to be selected, the contractor must first disclose his plans to and receive written approval from the Technology Utilization Division (TUD), NASA Headquarters.

   (b) Any additional subject area to be chosen must be one to which space generated research and development has made a significant contribution. The completed monograph must contain at least 2 NASA reports among the references. Any exception must receive prior written approval from Technology Utilization Division.

3. Recognized textbook authors or educational authorities in the technical areas selected shall prepare the monographs, or direct their preparation.

4. The number of monographs to be prepared when added to those completed under contract NSR 37-002-045, shall

not exceed 30 without prior approval from TUD. The minimum number to be completed is 28.

5. All draft monographs will be submitted to principal authors for review and approval prior to printing and distribution. Copies of transmittal letters will be sent to the Technology Utilization Division, NASA Headquarters.

6. Format for monographs to be prepared under this contract will be as that approved under Contract NSR 37-002-045 and subject to change as indicated by experience and the results of evaluation by participating professors.

7. The Contractor shall provide for the evaluation of each monograph by at least 10 participating professors for each monograph tested. If necessary, the services of a consulting organization will be employed to program this activity and otherwise assist in achieving this goal. (See 8 below).

8. In order to provide a sufficiently broad base for objective evaluation, the contractor will attempt to enlist the cooperation of professors at 25 participating institutions at the least. Consideration should be given to geographical dispersion as well as other factors in this selection.

9. The Contractor shall reproduce and have available for distribution sufficient copies of monographs to satisfy the demand for these materials.

10. The Contractor shall send five (5) instructor copies of each monograph completed under this contract to NASA Headquarters, Attention: Technology Utilization Division.

11. The evaluation of monographs should stem from qualitative opinions of participating professors. The Contractor will elicit such criticism and comment through use of a questionnaire prepared in such a way as to gather objective information regarding usefulness of the material to the professor, its technical content, and any other important factors.

12. The Contractor will be responsible for developing a matrix, the purpose of which will be to provide the means for quick

analysis of all interrelated factors which might affect the usefulness of monographs. The same type of matrix will be developed for visual briefs.

13. The Contractor shall send five (5) instructor copies and five (5) student copies of each completed monograph to NASA Headquarters, Attention: NASA Technical Reports Officer, Office of University Affairs.

B. Visual Briefs

1. Primary responsibility for identification, packaging and preparation of visual briefs lies with individual NASA Centers.

2. The Technology Utilization Division at NASA Headquarters shall have final authority in the acceptance or rejection of candidate materials. It shall provide necessary liaison with the contractor on all matters which arise prior to final approval of a specific visual brief.

3. It is anticipated that no fewer than 5 and no more than 10 visual briefs will be approved for trial dissemination during the contract period.

4. The Contractor will provide for the reproduction and storage of eight (8) sets of each visual brief approved for trial dissemination, including prints of the film or other visual aids which form on part of the visual brief package.

5. The Contractor will be responsible for distributing the visual briefs for evaluation purposes and for controlling the inventory.

6. The Contractor shall provide for the evaluation of each visual brief in at least 5 different classroom, workshop or seminar sessions. If necessary or advisable, the services of a consulting organization will be engaged to achieve this objective. (See paragraph A-7).

7. Based on feedback information or experience gained under Contract NSR 37-002-045, the Contractor, subject to approval of the Technology Utilization Division, may alter the format and/or packaging of the visual brief and suggest other refinements to develop the best specifications for academically useful visual briefs.

ARTICLE II

PERIOD OF PERFORMANCE

The work to be performed hereunder shall be for a period of one (1) year beginning June 1, 1966 and shall be completed on or before August 31, 1968.

ARTICLE III

COST

Total estimated cost of this contract is two hundred and ten thousand and ninety-nine dollars ($210,099.00).

ARTICLE IV

INDIRECT COSTS

Subject to the provisions of Clause 36 "Negotiated Overhead Rates (Postdetermined) (January 1964)" the Contractor shall be reimbursed for its allowable overhead rate at the following provisional rate for the period specified below:

Rate	From	To
50.25% of salaries and wages provisionally	June 1, 1966	August 31, 1968

ARTICLE V

DATE OF INCURRENCE OF COSTS

The Contractor shall be entitled to reimbursement for costs incurred in an amount not to exceed $25,100.00 on or after September 1, 1967 which, if incurred after this contract had been entered into, would have been reimbursable under the provisions of this contract.

ARTICLE VI

SPECIFIC ALLOWABLE COSTS

Notwithstanding the provisions of the clause of this contract entitled "Allowable Cost and Payment," the following allowable costs are hereby applicable under this contract:

The Contractor may pay allowable consultant fees (not to exceed $100.00 for an eight hour day) to the professorial

reviewers in other educational institutions for review and evaluation of the instructional materials (i.e. monographs and Visual Briefs), although the Contractor is encouraged to work out non-cash reimbursable arrangements whenever possible.

The above shall be reported as separate budget categories.

ARTICLE VII

FINANCIAL OPERATIONS

It is agreed that income received by the Contractor from client subscribers for services rendered or committed shall be expended for operations and development of the program hereunder in accordance with a financial plan of operations which shall be submitted to the Contracting Officer within 60 days of the date of execution of this contract. This plan may allocate income to current operations or to a reserve fund to be established and segregated from all other funds, for the purposes set forth in this Article. In no event may any such financial plan allocate income derived hereunder (including any earnings on the reserve fund) to any function or for any purpose not reasonably related or allocable to the operation or development of the program. The financial plan of operations shall be reviewed semi-annually by the parties hereto, the first such review to occur eight months from the date of execution of this contract. Any change in such plan shall be approved in writing by the Contracting Officer. The administration of income derived hereunder and the reserve funds established hereunder shall be subject to the clauses of this contract entitled "Records", "Audit and Records" and "Reporting Requirements". In the event of termination of this contract for any reason, all reserve funds and uncommitted income derived hereunder shall be paid to the Government.

ARTICLE VIII

TECHNICAL DIRECTION

As used herein, the phrase "technical direction" encompasses directions to the Contractor which complete the general description of the work set forth in this contract. This may not include new assignments of work, may not be of such a nature as to increase or decrease estimated costs or period of performance, and may not affect any other provision of this contract. Work to be performed under this contract shall be subject to the technical direction of the following official or his designee:

Director
Technology Utilization Division
Office of Technology Utilization
National Aeronautics and Space Administration
Washington, D.C. 20546

ARTICLE IX

THIRD PARTY PATENTS

The Contractor understands that the National Aeronautics and Space Administration makes no representation that the National Aeronautics and Space Administration has the right to make, use, or sell inventions disclosed in the performance of this contract or that the practice of inventions disclosed in the performance of this contract or that information furnished by the National Aeronautics and Space Administration will not infringe outstanding patents owned by third parties.

ARTICLE X

PUBLIC INFORMATION

No news release or public announcement or any part of the subject matter of this contract or any phase of any work hereunder shall be made without prior approval by the Government official designated as responsible for technical direction of the work performed hereunder. As used herein, the phrase "news release or public announcement" means materials prepared for release to news media or other publications, brochures, and scripts regularly used for presentations. It does not mean speeches or presentations in which the services to be provided by the ontractor are routinely mentioned or explained by university or state officials not employed for the performance of work hereunder.

ARTICLE XI

PARTIAL CONSIDERATION

In partial consideration of work and reports required hereunder, the Government will provide to the ontractor the NASA information resource materials which are, as determined by the Government official designated as responsible for technical direction of the work performed hereunder, necessary or useful to the Contractor's operation and such other consideration as may be elsewhere provided for hereunder.

ARTICLE XII

REPORTING REQUIREMENTS

Quarterly Progress Reports. The Contractor shall submit separate quarterly reports on the progress of each task accomplished during each three-month period of contract performance. In addition to factual data, these reports shall include a separate analysis section which interprets the results obtained, recommends further action, and

relates occurrences to the ultimate objectives of the contract work. Sufficient diagrams, sketches, photographs, and drawings shall be included to convey the intended meaning. The third and fourth quarterly reports shall include discussions on the results of the effort at the point in time when the reports are prepared. Quarterly reports shall be submitted in ten (10) copies, including one suitable for photographic reproduction.

Oral Reports. Oral presentations on the progress of each task and recommendations for possible modifications of the remaining effort shall be made to NASA Headquarters, at the end of the first and third quarters of the contract.

Financial Reports. The Contractor shall submit NASA Form 1030 (2-64), University and Nonprofit Institution Financial Management Report, within 15 days after completion.

Final Report. The Contractor shall submit a final report which documents and summarizes the results of the entire contract work, including recommendations and conclusions based on the experience and results obtained. The Final report shall include tables, graphs, diagrams, sketches, photographs, and drawings in sufficient detail to comprehensively explain the results achieved under the contract. The final report shall be submitted in ten (10) copies, including one suitable for photographic reproduction.

Distribution of Reports - Quarterly Progress, Financial and Final
The Contractor shall submit copies as indicated below:

Director, Technology Utilization Division Code UT NASA Headquarters Washington, D.C. 20546	(5 copies)
Deputy Director, Educational Programs Office of Public Affairs Code FE NASA Headquarters Washington, D.C. 20546	(1 copy)
NASA Technical Reports Officer Office of University Affairs Code Y NASA Headquarters Washington, D.C. 20546	(10 copies, plus 1 camera-ready copy)

ARTICLE XIII

ALTERATIONS IN CONTRACT

Add the attached GENERAL PROVISIONS [NASA Form 419 (2-65)] and the ADDENDUM TO GENERAL PROVISIONS (NASA Form 419 [2-65]) (Revised).

SCHEDULE

ARTICLE I

Statement of Work

1. The Contractor shall provide the necessary personnel, equipment and facilities to review technical reports and related material supplied by NASA and Technology Use Studies Center at Southeastern State College in Durant, Oklahoma - with the objective of selecting information that would be of significant benefit to graduate and undergraduate engineering educational programs - in specialized technical areas selected by mutual agreement between the Office of Engineering Research at Oklahoma State University and the Office of Technology Utilization at NASA Headquarters.

2. From the selected information, the Contractor shall prepare instructional materials (i.e. topical monographs) as appropriate for use in graduate and undergraduate engineering educational programs. Recognized textbook authors or educational authorities in each of the specialized technical areas selected, are either to prepare these materials or to direct their preparation.

3. The Contractor shall recommend several preferred trial formats for the instructional materials to NASA, which will approve one or more formats for use in the trial dissemination as delineated in item 6 hereunder.

4. The Contractor shall make arrangements for the NASA approval of each instructional material prepared.

5. The Contractor shall review a number of different Engineering and Science Series Visual Briefs, with supporting texts, provided by NASA, and selected approximately 20-30 Briefs for use in graduate and undergraduate engineering education programs.

6. (a) The Contractor shall reproduce and distribute enough copies of each approved instructional material to a selected group of approximately ten educational institutions of higher learning for simultaneous review, evaluation and trial dissemination. (See item 6(c) for further details).

   (b) The Contractor shall reproduce and distribute enough copies (approximately eight) of each of the selected Visual Briefs to a selected group of approximately ten educational institutions of higher learning for purposes of review, evaluation and trial dissemination as further explained in item 6(c) hereunder.

(c) The purposes of this review, evaluation and trial dissemination to these selected groups of institutions are (1) to have professorial and student review and evaluate the instructional materials for their general usefulness and suitability as supplementary informational materials in graduate and undergraduate engineering classroom situations and (2) to gain some insights into the problems of instructor usage of the materials and of dissemination of the materials. More specifically the review and evaluation of each monograph, Visual Brief and other instructional material should be in terms of its subject's importance and pertinence, the adequacy of its content, its contribution to understanding, its form, its length, and other concerns deemed appropriate. The text portion of each Visual Brief should be evaluated additionally for its adequacy in imparting understanding of the details of the visual materials, as appropriate.

7. The Contractor shall collect and summarize review comments and evaluations and proffered recommendations from the participating educational institutions and make recommendations to NASA for future preparation, publication and dissemination of instructional materials, considering each point of evaluation illustrated in paragraph 6(c) above.

8. The Contractor shall recommend which particular specialized technical area should be the subject basis for future instructional materials.

9. The Contractor shall judge the usefulness and suitability of the Visual Briefs for educational purposes outside of direct classroom use such as for use in illustrated film lectures, to provide the basis for seminars, etc.

10. The Contractor shall determine whether college instructors and professors are reluctant to use visual materials in classroom situations, and, if so, why, and recommend the best ways for NASA to make visual materials available so they may often and easily be used effectively in college classroom situations.

11. The Contractor shall investigate and report to NASA in detail costs involved in conversion for effective use and reproduction of the visual materials of the Visual Briefs, considering the original mode of presenting the visual material and one or two of the recommended modes of presenting the visual material.

12. The Contractor shall investigate methods of preparation, approval and dissemination of the instructional materials other than those utilized in the above trial dissemination, and based on the experience of the

above trial dissemination, shall recommend the best ways for these materials to be prepared, approved and disseminated on a nationwide scale. The performance of this task is contingent upon positive recommendations to proceed with preparation, publication and dissemination of the instructional materials resulting from the performance of item 7 above. Consideration shall be given to the practicality of joint efforts by NASA and other federal agencies with educational missions to disseminate these materials most effectively.

13. The work shall be conducted under the general direction of Dr. Clark A. Dunn, Associate Dean of the College of Engineering, unless a replacement is agreed to by the Government.

14. The work shall be conducted generally in accordance with the Contractor's Proposal No. 37-002-045, dated March 16, 1966, entitled "A Pilot Program for Selecting, Editing and Disseminating Engineering and Scientific Educational Subject Matter from NASA Technical Reports."

ARTICLE II

Period of Performance

The work to be performed hereunder shall be for a period of one (1) year beginning June 1, 1966 and shall be completed by May 31, 1967.

ARTICLE III

Cost

The total estimated cost of this contract is one hundred and ten thousand five hundred and ninety-nine dollars ($110,599.00).

ARTICLE IV

Indirect Costs

Subject to the provisions of Clause 36, "Negotiated Overhead Rates (Postdetermined) (January 1964)," the Contractor shall be reimbursed for its allowable overhead rate at the following provisional rate for the period specified below:

Rate	From	To
50.25% of salaries and wages provisionally	June 1, 1966	May 31, 1967

ARTICLE V

Specific Allowable Costs

Notwithstanding the provisions of the clause of this contract entitled "Allowable Cost and Payment," the following allowable costs are hereby applicable under this contract:

1. Reproduction costs for the Visual Briefs shall be limited to $12,000. Unit costs for such reproduction should be at the lowest possible cost, yet high quality reproduction should be achieved.

2. The Contractor may pay allowable consultant fees (not to exceed $100.00 for an eight hour day) to the professorial reviewers in other educational institutions for review and evaluation of the instructional materials (i.e. monographs and Visual Briefs), although the Contractor is encouraged to work out non-cash reimbursable arrangements whenever possible.

3. The purchase of technicolor Instant Movie Projectors, Model Number 800, is hereby authorized at a total cost not to exceed $900.00, in order to better serve the purposes of other institutional review and evaluation of the Visual Briefs.

Each of the above shall be reported as separate budget categories.

ARTICLE VI

Date of Incurrence of Costs
(October 1963)

The Contractor shall be entitled to reimbursement for costs incurred in an amount not to exceed $27,599.00 on or after June 1, 1966 which, if incurred after this contract had been entered into, would have been reimbursable under the provisions of this contract.

ARTICLE VII

Technical Direction

As used herein, the phrase "technical direction" encompasses directions to the Contractor which complete the general description of the work set forth in this contract. This may not include new assignments of work, may not be of such a nature as to increase or decrease estimated costs or period of performance, and may not affect any other provision of this contract. Work to be performed hereunder shall be subject to the technical direction of the following official or his designee:

Director, Technology Utilization Division
Code UT
Office of Technology Utilization
NASA Headquarters
Washington, D.C. 20546

ARTICLE VIII

Reporting Requirements

It is the intent of the NASA that the useful research information obtained under this contract be published by the NASA, or in technical journals, or in transactions or proceedings of technical meetings. The Contractor should prepare reports for publication at any time a useful body of information has been obtained.

Quarterly Progress Reports. The Contractor shall submit separate quarterly reports on the progress of each task accomplished during each three-month period of contract performance. In addition to factual data, these reports shall include a separate analysis section which interprets the results obtained, recommends further action, and relates occurrences to the ultimate objectives of the contract work. Sufficient diagrams, sketches, photographs, and drawings shall be included to convey the intended meaning. The third and fourth quarterly reports shall include discussions on the results of the effort at the point in time when the reports are prepared. Quarterly reports shall be submitted in ten (10) copies, including one suitable for photographic reproduction.

Oral Reports. Oral presentations on the progress of each task and recommendations for possible modifications of the remaining effort shall be made to NASA Headquarters, at the end of the first and third quarters of the contract.

Financial Reports. The Contractor shall submit NASA Form 1030 (2-64), University and Nonprofit Institution Financial Management Report, at the completion of each contract quarter. Separate reports shall be submitted on costs expended by major budget category for task groupings (a) 1-4, (b) 5, (c) 6-9, (d) 10, and (e) 11-12. In addition, the Contractor shall investigate and report in detail costs involved in conversion for effective use and reproduction of the visual materials of the Visual Briefs, considering the original mode of presenting the visual material and one or two of the recommended modes of presenting the visual material.

Final Report. The Contractor shall submit a final report which documents and summarizes the results of the entire contract work, including recommendations and conclusions based on the experience and results obtained. The final report shall include tables, graphs, diagrams, sketches, photographs, and drawings in sufficient detail to comprehensively explain the results achieved under the contract. The final report shall be submitted in ten (10) copies, including one suitable for photographic reproduction.

Distribution of Reports - Quarterly Progress, Financial and Final
The Contractor shall submit copies as indicated below:

Director, Technology Utilization Division (5 copies)
Code UT
NASA Headquarters
Washington, D.C. 20546

John Keeler (1 copy)
Chief, Engineering Operations Branch
Technical Division
Western Operations Office
150 Pico Boulevard
Santa Monica, California 90406

Deputy Director, Educational Programs (1 copy)
Office of Public Affairs
Code FE
NASA Headquarters
Washington, D.C. 20546

NASA Technical Reports Officer (10 copies)
Office of Grants and Research Contracts
Code SC
NASA Headquarters
Washington, D.C. 20546

General Requirements. All reports prepared under this contract shall contain acknowledgement of NASA support and identify the contract under which the work was performed.

In the event that the Contractor elects publication in a technical journal, or in transactions or proceedings of technical meetings, five (5) copies of Preprints or Reprints are required. The Contractor shall furnish the name of the journal or technical group to which the material will be presented. Material submitted for NASA publication shall be in the style and format prescribed for NASA Technical Notes. Further information regarding this requirement will be furnished on written request.

Reference to published material resulting from this contract may serve as part or all of the reports called for herein.

Public Information. No news release or public announcement on some or any part of the subject matter of this contract or any phase of any work hereunder shall be made without prior approval by the Government official designated as responsible for technical direction of the work performed hereunder.

ARTICLE IX

Alterations in Contract

Add the attached ADDENDUM TO GENERAL PROVISIONS [NASA Form 419 (2-65)].

ADDENDUM TO GENERAL PROVISIONS (NASA Form 419 [2-65])

The following alterations, deletions and additions are hereby made to the General Provisions NASA Form 419 (February 1965).

1. Clause 17 - Equal Opportunity is amended by deleting all reference to:

   (i) President's Committee on Equal Employment Opportunity;
   (ii) Executive Order 10925 of March 6, 1961, as amended by Executive Order 11114 of June 22, 1963, and
   (iii) Section 303 of Executive Order 10925 of March 6, 1961, as amended by Executive Order 11114 of June 22, 1963.

   and substituting therefor:

   (i) Secretary of Labor;
   (ii) Executive Order 11246 of September 24, 1965, and
   (iii) Section 204 of Executive Order 11246 of September 24, 1965,

   respectively.

2. In Clause 25 - Government Property, paragraph (c) (2), line 6 delete the amount "$3,000.00" and substitute in lieu thereof the amount "$1,000.00."

3. Add the attached Clause 35 - Property Rights in Inventions.

4. Add the attached Clause 36 - Negotiated Overhead Rates.

5. Clause 23 - Rights in Data, is amended by adding the following to the end of the first sentence of paragraph (a) of that clause: "or which are in fact delivered to the Government in the performance of this contract."

Clause 35

PROPERTY RIGHTS IN INVENTIONS

"This contract and all subcontracts hereunder are subject to Section 305 of the National Aeronautics and Space Act of 1958 relating to property rights in inventions. The term "invention" includes any invention, discovery, improvement, or innovation. Any invention made in performance of work under this contract shall be presumed to have been made under the conditions described in paragraphs (1) or (2) of Section 305(a) of the Act. The Contractor shall furnish to the Contracting Officer a written report containing full and complete technical information concerning any invention made in the performance of any work under this contract promptly upon the making of such invention and shall require all subcontractors to do so. Upon written request of the Contracting Officer, Contractor shall furnish additional information available to him, and shall secure the execution of such documents as may be necessary to enable the administrator,NASA,to file and prosecute patent applications on any such invention. Prior to completion of this contract, the Contractor shall furnish to NASA a report as to whether or not any inventions of the type referred to herein have been made in the performance of work under this contract."

Clause 36

NEGOTIATED OVERHEAD RATES (POSTDETERMINED)
(January 1964)

(a) Notwithstanding the provisions of the clause of this contract entitled "Allowable Cost and Payment," the allowable indirect costs under this contract shall be obtained by applying negotiated overhead rates to bases agreed upon by the parties, as specified below.

(b) The contractor, as soon as possible but not later than six (6) months after the expiration of each period specified in the Schedule shall submit to the Contracting Officer, with a copy to the cognizant audit activity and the Office of Procurement, NASA Headquarters, a proposed final overhead rate or rates for that period based on the contractor's actual cost experience during that period, together with supporting cost data. Negotiation of final overhead rates by the contractor and the negotiating authority shall be undertaken as promptly as practicable after receipt of the contractor's proposal.

(c) Allowability of costs and acceptability of cost allocation methods shall be determined in accordance with Part 15, Subpart 3, of the NASA Procurement Regulation as in effect on the date of this contract.

(d) The results of each negotiation shall be set forth in a modification to this contract which shall specify (i) the agreed final rates, (ii) the bases to which the rates apply, and (iii) the periods for which the rates apply.

(e) Pending establishment of final overhead rates for any period, the contractor shall be reimbursed either at negotiated provisional rates as provided in the Schedule or at billing rates acceptable to the Contracting Officer subject to appropriate adjustment when the final rates for that period are established. To prevent substantial over- or underpayment, the provisional or billing rates may, at the request of either party, be revised by mutual agreement either retroactively or prospectively. Any such revision of negotiated provisional rates provided in the Schedule shall be set forth in an amendment to this contract.

(f) Any failure by the parties to agree on any final rate or rates under this clause shall be considered a dispute concerning a question of fact for decision by the Contracting Officer within the meaning of the "Disputes" clause of this contract.

APPENDIX XI

SAMPLE COPY

MONOGRAPH EVALUATION SHEET

APPENDIX XI

MONOGRAPH EVALUATION
(Please complete in applicable areas)

TITLE _____

Name of Respondent: _____

Department: _____ University _____

Years of engineering teaching experience _____

1. Course in which Monograph was used:

   Course No. _____ Title _____

   Course level: Graduate _____ Advanced Undergraduate _____

   Course credit (hours): Semester _____ Quarter _____

   Number of students in course _____

2. General Information on Monographs:

   Was the technical information covered in the Monograph of value in course presentation? Good _____ Some _____ Little _____

   Should the Monographs include more information than was presented? More _____ Same _____ Less _____

   Is the format of the Monographs appropriate for use in engineering courses? Good _____ Fair _____ Poor _____ Incorrect _____

3. Comments on Monograph from classroom use:

   Was the Monograph used in a classroom situation? Yes _____ No _____

   Was the Monograph used in context with closely related material in the course presentation? Yes _____ No _____

   Did the technical information in the Monograph contribute to the further understanding of the course material by the students in the course? Great _____ Some _____ Little _____ None _____

   Were the home problems in the Monograph too complex? Not Used _____ Too Complex _____ Useful _____ Too Simple _____ Unnecessary _____

   How many hours of classroom lecture time should be allocated for presentation of this Monograph? _____

   Would you use the Monograph if you taught the course again? Yes _____ No _____

4. In your opinion, are Monographs a useful method of presenting new technical information in the classroom until the material can be included in a textbook? What are the good points? Any improvements needed?

5. Should a program of preparing Monographs be expanded to cover a wide variety of subject areas? Would you use them frequently if you taught classes in the subject areas?

OKLAHOMA STATE UNIVERSITY
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